# TIME PREDICTION

# AN ALTERNATIVE APPROACH

by

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## ABSTRACT

The construction industry and its commercial and industrial clients have become increasingly aware of the importance of time in the planning and constructiion of projects. A comparison of the construction industries in the UK and the USA concluded that orthodox contract procedures in the UK are largely determined by public sector requirements of accountability and control, whereas private sector requirements are for speed and a clear allocation of responsibilities and tasks. The important relationship between time and cost has not been studied to any extent in UK practice.

It is clear from the little research that has been undertaken that the subjective methods of time prediction adopted by surveyors in the UK are far from being adequate when it can only be expected that 50% of contracts will meet the stipulated contract period. The problem is one of trying to predict a time period without being able to fully anticipate all possible future events. To date the industry has had no scientific method of making that time prediction, moreover it is often left simply to the judgement of a professional quantity surveyor. In order to provide a better and more effective time and cost control system, it is imperative that a more accurate system or predicting time is devised.

This research then aims to identify the factors affecting the time aspect of construction, to suggest which of those could be anticipated at a given point during the design procedure and to prepare a model whereby the time for consturction can be accurately predicted.

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# CHAPTER ONE

# INTRODUCTION

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## INTRODUCTION

The construction industry and its commercial and industrial clients have become increasingly aware of the importance of time in the planning and construction of projects. A comparison of the construction industries in the United Kingdom and the United States made by the Royal Institution of Chartered Surveyors (1979) concluded, inter alia, that orthodox contract procedures in the United Kingdom are largely determined by public sector requriements of accountability and control, whereas private sector requirements are for speed and a clear allocation of responsbilities and tasks. The important relationship between construction time and cost, however, although dealt with on a theoretical basis by Hillebrandt (The Economics of Construction), has not been studied to any extent in practice.

It is a common complaint of the client who obtains finance from an external source, that any increase, or indeed decrease, in the actual contract period can prove to be very expensive. A contract completed early is as much a failure as one completed late; the client may not obtain any benefit from early completion and may have paid out monies before it was needed thus losing interest on capital. It would, therefore, be an advantage to a client if he could be assured that, assuming there are no design modifications or any other unforseen changes, the contract period will remain as predicted.

The time/cost relationship is a very complex one that has attracted few research studies and is defined as the time taken to complete the project to practical completion (contract duration) as a function of cost (estimated contract value). Cost was chosen as the major explanatory variable, rather than size or some other factor, because it is considered that cost is a measure of both size and complexity. This is of course affected by many other factors and it is anticipated that these will be identified in the regression analysis carried out. It is assumed therefore that, for the purpose of this research, cost is taken as a proxy measure for size.

Contract period is defined as that time stated in the contract documents, where contract duration is how long the project actually took to complete. It is clear from reviewing other research in this area that there are difficulties in predicting time. It was decided therefore to see what results would emerge if a fairly simple approach, with a simple questionnaire were adopted.

Through his research in the seventies in Australia, Bromilow stated that:

> "Variations are the cause of many problems in building contracts and are the source of increase in time and cost and concluded that:

> Changes during construction are inevitable and must be allowed for in planning and carrying out building construction".

The problem is one of trying to predict a time period without being able to fully anticipate all possible future events. It is easy with hindsight to say that the period should have been 6 or 8 weeks longer. This research aims to identify the factors affecting the time aspect of construction, to suggest which of those could be anticipated at a given point during the design procedure and to take account of them in the original time calcluation.

An accurate time prediction will avoid any expensive increases in funding, will make more economic use of valuable resources and will help to keep the client satisfied. This research is presented in the following way:

Chapter Two deals with the problems of predicting time and sets out to identify those factors which may affect time within broad areas. These factors then form the basis of the data collection and statistical analysis.

Chapter Three is concerned with the current procedures available throughout the world for predicting time and deals with three such methods. The three models detailed each adopt a different perspective of time; the first is a general model intended for universal application (Bromilow); the second is related to a procurement method (Heery); and the third is related to a method of construction (CLASP). Each method is considered here in detail.

Chapter Four deals with the collection of data and its classification into categories. The data were collected by means of a questionnaire which resulted in a return of 21 per cent. This was disappointing but was considered sufficiently large to carry out an analysis. The data were analysed following the stepwise regression proccedure using the Statistical Package for Social Scientists (SPSS, Nie et al, 1979). The multiple regression analysis shows the strength of the relationship between the variables.

Chapter Five looks at the data by describing the variables and identifying those which have quantitative values and those which are qualitative in nature. The second part of the chapter analyses the data as produced using the stepwise regression procedure. Variables which are significant to the prediction of time are identified.

Chapter Six concludes this research and attempts to explain why those statistically significant variables are so important in the prediction of time.

# CHAPTER TWO

# TIME PREDICTION - THE PROBLEMS

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### Introduction

Delay in construction means the time overrun beyond the stated contract period. For the building owner delay means the facilty is not available for use and lost revenues that can never be recovered. For the contractor delays means higher direct and overhead costs because of the extended period of construction with working capital tied up so that he may be prevented from pursuing other contracts. Delay usually involves loss on both sides.

A study by F.J. Bromilow was carried out during the period 1964-67 to investigate among other things, the differences between the contract period and the contract duration. He found that the differences between the contract period and the contract duration were substantial and much larger than commonly believed, (Bromilow 1969). The survey was directed to projects costing more than A$10,000 in value, located in or close to Canberra, Melbourne and Sydney with special attention to office building. The results showed that of the 329 contracts analysed, only 12.5% were completed within the time orginally expected and the overall average extra time taken exceeded 40%.

The Wood Report (1975) which carried out a survey of 2,000 public sector building and civil engineering projects demonstrated its results against three performance indicators. One of these is the time performance yardstick defined as the percentage difference between the original contract period and the contract duration. The statistical survey showed that contract periods are set rather loosely in that they were set mainly on intervals of three and six months. The average time overrun for the whole sample was 17.4% compared with the sample for this research of 21% and that of Bromilow's research at 40%.

The Banwell Report (1964), stated that:

> "insufficient regard is paid to the importance of value of time and its proper use in all aspects of the project from the client's original decision to build, through the design stages and up to final completion".

The results of the survey carried out under this research detailed in Chapters Four and Five confirm the findings of both Bromilow and Banwell. Of 214 Contracts taken from a wide range of environments and building types, 41% took longer to complete than orignally stated with an average overall extra time taken exceeding 21%. Of the remainder, 50% were completed on time and 9% were completed early.

It is clear that the subjective methods used by surveyors for predicting contract periods are far from being adequate since it can only be expected that 50% of contracts will meet the stipulated construction period. As indicated in Chapter Five, in some cases the reason why extra time was required is attributable to bankruptcy, a factor which could not have been foreseen at the time of predicting the contract period. What is not clear, however, is whether such bankruptcies were triggered by an unreasonably short construction period orginally being stated. Bromilow (1969) found that attempts to achieve very short contract periods were generally abortive. This chapter aims to identify the problems and the factors affecting that prediction.

### Stage at which time prediction may be made

There can be a need for time prediction at various stages throughout the design. Even at the very earliest stages in the case of the developers budget, perhaps before there is any design, or the need may not arise until the design is complete. Expectations as to the actual date of completion may change as the design and construction processes proceed. To predict the time too early with insufficient data would be folly. As more information becomes available on the project so a more accurate prediction of construction time would be made.

The estimated cost of the project will vary and presumably become more accurate as the design develops. A prediction of time based upon cost will therefore take account of the improved information through the cost of the project. It is possible in this way to be able to predict time at almost any stage in the design process with varying degrees of accuracy and thus the client can be kept informed of any new developments in respect of time. This research is therefore aimed at any stage where an estimated cost is available to the surveyor. The degree of accuracy of that prediction must however be given in the context of the accuracy of the estimate of cost.

## Factors affecting time

In order that an accurate prediction of the construction period may be made, it is first necessary to identify those factors which may affect the construction process adversely or otherwise. Almost every aspect of a project will have an effect upon how long it takes from starting on site to completion. These aspects can be grouped into four broad areas:

(1) physical effects
(2) environmental effects
(3) external effects
(4) managerial effects

## (1) PHYSICAL EFFECTS

The term 'physical effects' is used here to embrace any factors directly associated with the building or land upon which it is to be built. Such factors will include:

(a) project type
(b) estimated cost of project
(c) size and complexity

The main physical effects arise from the inherent complexity and uncertainty about the building process. Complexity can be seen as the technical difficulties encountered in construction and uncertainty as unfamiliarity with the proposed scheme. These will inevitably have an adverse effect upon the cost of the project and in turn on the time taken to construct the building.

Where this complexity and uncertainty can be removed, as in the case of the CLASP School Programme, a direct relationship between time and cost can be established (see Chapter Three, Nottinghamshire County Council model). This inherent complexity is frequently experienced in the amount of services installations required such as heating, hot water, air-conditioning, gas, compressed air, light, power etc. It is expected that an increase in the amount of services required will lead to an increase in both time and cost.

It is clear that the cost of a project has some bearing upon how long it will take to construct. The relationship is not thought to be a simple one for traditionally constructed buildings, with the greater the cost the longer the time. Bromilow (1969) realised that there was a sensitivity of time performance to cost level and in his model, detailed in Chapter Three, he expressed this as a constant measuring the extent to which additional time is taken during construction as projects increase in size measured by cost. It is expected that the cost of a project will bear some relationship to the size of the project and in this respect cost is being used as a proxy measure for size. This may or may not be an accurate assessment of the relationship and may in some circumstances not stand true. It is however thought that this goes some way to explaining the size of the project together with its complexity of construction.

Uncertainty can also be created where there exists an overlap of design and construction. Although it could be expected that the overall time required for both processes will be reduced, the actual construction time and cost are increased in comparison with projects where this overlap did not occur (Ireland 1985)

The Wood Report (1975) in applying its time performance yardstick identified housing, medical and 'other building' categories as having the highest time overrun. Road and education projects conversely had the lowest time overrun with education projects most consistently near the programme completion date. Clearly the pressures placed on the building team by the client have some bearing on the success of the project in terms of contract duration and in some cases this can be enforced with the careful choice of procurement method.

### (2) ENVIRONMENTAL EFFECTS

The term 'environmental effects' is used here to identify any climatic or location factors which may affect the progress of the works. Such factors may include:

(a) the time of the year the project commences on site
(b) location of the site

On construction sites in the United Kingdom more delays and loss of working time are caused by rain than by other climatic condtions. (King 1981). The loss of time depends on the rain duration rather than the amount of rainfall. The notable feature of monthly averages of daytime rain duration is the low value in the summer months compared to winter months. This contrasts with the situation for rainfall amount where there is no marked seasonal variation in rainfall totals.

Where the effect of rain on outdoor working time is related to rain duration, King (1981) found that rain occupied between 4 per cent and 7 per cent of daytime hours with rain duration least in the summer months. Considerable variations from this are not unusual. In many places during the summer there are only an average of two 'wet days' per month. A 'wet day' is considered to be one where for a total duration of two hours between 0700 and 1700 GMT the rainfall amount is at least 0.2 mm in the hour. In terms of duration, while the west is wetter than the east, these differences are not large.

The effect, on the construction processes, of rain and other climatic conditions is often greater than the duration of the climatic event. Outdoor work does not always stop and start in step with the rain. For some processes, work may have to be halted for the whole day even though the rain is actually falling for less than half this time. It has been found that most urban areas have between 30 and 50 'wet days' per year. It is important for some purposes to have a day with no interruptions by rain, although a very light fall may be tolerated. Days where the amount of rain is less than 0.2 mm are considered 'dry days'. Similarly it has been found that there are on average between 210 and 260 'dry days'.

### (3) EXTERNAL EFFECTS

The term 'external effects' is used here to include any external forces which may affect the project. These may include:

(a) economic factors

(b) market forces

The effects of a change in the level of economic activity on the construction industry are well established and well documented. Hillebrandt (1979) defines the relationship of the construction industry to the economy in terms of basic supply and demand theory. The relationship between contract cost and contract duration is likely to change with time as a result of changing levels of activity within the industry and in response to the development of new constructional and contractual methods.

Organisations in the construction industry exercise less control over their market than in many manufacturing industries. Building is largely bespoke and as such the industry is less able to shape its market or to plan to take advantage of expected market trends. As a consequence, organisations in the construction industry face uncertainty about the future.

This uncertainty is formalised in two ways. Firstly by lack of forward commitment and a threat that resources will have to be redeployed. Not only are many construction materials and crafts used by other industries, but there is also a significant movement between the construction and other industries. Thus, the higher the level of activity in those other industries, the more difficult it is for additional resources to be attracted into the construction industry without causing an overheating of the economy. An overheated economy is one where prices are higher than they would normally be, caused by excessive demand on a limited supply. These links can mitigate the effects of a downturn in construction demand provided that the other industries are not also depressed.

The second consequence of uncertainty is that organisations seek to obtain more work than would be required if the timing envisaged in the programmes of design and construction were realised. As a result, construction proceeds much more slowly than justified by the amount of work to be completed in the time allowed, with each organisation having a stockpile or work to be drawn on when projects are delayed.

### (4) MANAGERIAL EFFECTS

The term 'managerial effects' is used here to identify the role of the professionals and contractor personnel in the progress of the works. These may include:

(a) procurement method
(b) client

A procurement method is a term used to describe the management approach and the conditions of contract in use on building projects.

Procurement methods are defined as the overall management structure and specific management practices in use on a project.

These are determined by the roles played by the participants as well as the formal contracts used. The term 'procurement method' has the sense of describing the roles of participants, the relationships between them both formal and informal, the timing of events and the practices and techniques of management in use. Examples of the more commonly used procurements methods are: a single lump sum contract on a fully documented scheme; provisional or partial quantities; cost reimbursement contracts; package deal contracts; management fee contracts. The wrong choice of procurement method will undoubtedly affect both the final cost and the contract duration time for the project.

Any organisation, in order to make the best of it circumstances, must arrange its affairs so that the resources deployed are utilised to the maximum advanatge. This utilisation of resources is measured in terms of productivity. Productivity is crucially affected by the interplay between design, which determines the buildability of projects, and management which is responsible for allcoating resources and for controlling time. A conflict often arises however in that the high utilisation of resources can always be achieved by a sufficiently slow rate of progress.

Uncertain control over timing of projects is however one characteristic of the construction industry. In occupations as fragmented and as interwoven as building, as much affected by site conditions and weather, there is an uncertainty surrounding the timing of projects.

## SUMMARY

In practice the task of predicting time is considerably more complex than might be expected. Many things happen to interfere with the smooth flow of work: delays occasioned by the weather; by materials not being available or by being rejected upon inspection; technical hitches like the breakdown of equipment; uncertainty caused by inadequate detailing on the part of designers; delays whilst drawings are rectified or indeed produced for the first time.

Sometimes main contractors find it difficult to achieve effective control, especially when many nominated sub-contractors or suppliers are involved. Other disturbances are often external to the parties bound by the contract, more particularly where there is a lack of co-operation by statutory authorties.

By no means are the time overruns on contract time all the fault of the contractor. In many cases it is the client who has a large effect on the delay; by stopping work due to cash flow problems or not providing the contractor with necessary information when it is requested. However, it is the cleint who is left to pay for the cost of any prolongation of the contract.

This research addresses many of these issues but acknowledges that some will fall outside of the bounds of prediction prior to the contract being signed and others are too general to be incorporated into a time prediction model. These issues are identified here and are such that surveyors, or those attempting to predict time, should be aware of their possible implications on time and cost.

### 1. Contractor personnel

Unless the project is based upon the design and build procurement method, it is unlikely that the contractor personnel would be known or or even anticipated during the early stages. The problem of contractor personnel should be catered for at the tendering stage. A good reputation for workmanship and mangerial ability should be high in priority when selecting a contractor. All too many contractors are selected on the basis of price alone with little attention being paid to a proven 'track record' with the client being left to pick up the pieces. In the worst event a wrong choice can result in contractor bankruptcy which in turn will lead to a significant increase in the time element and undoubtedly an increase in cost.

## 2. Economy

This will be reflected in the contract sum though again, in appraising tenders account should be taken of the effect of current market forces on productivity. This is not always a simple task of making an analysis of the economy, other factors need to be considered. If for example due to overheating of the economy, the cost of building increases 10% and the time taken to erect the building also increases 10%, then the time cost relationship is not affected. Inflation on the other hand may affect cost only, or as in the period 1980-84 it may have little if any effect. All these factors need to be borne in mind in making such value judgements.

## 3. Design

An essential component to successful completion appears to be a fully designed scheme prior to obtaining tenders. It should be the aim of the design team to have a fully detailed scheme at tendering stage and if necessary the obtaining of tenders should be delayed until such time as the scheme is fully designed. The effects of this are shown in this research and are well documented.

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# CHAPTER THREE

# TIME PREDICTION - THE CURRENT METHODS

# CHAPTER THREE

# TIME PREDICTION : THE CURRENT PROCEDURES

## Introduction

The prediction of the contract period is a requirement in producing necessary contract documentation. There is normally an obligation to provide a statement as to the length of the contract period. This is not always the case however as some Local Authority clients ask tenderers to quote both the cost sum and the time the tenderer requires to carry out the works. This time, if accepted, then becomes the contract period. In this case the time is being predicted, but by the tenderer and not the quantity surveyor, however it is likely that the client would have required some estimation of contract period prior to tendering to allow essential financial calculations to be made and to provide a check against tenderers estimations. Where there is a requirement for time prediction, then it can be considered in one of two ways:

1. that the cost of the project depends upon the time at which occupation is required (stipulated contract period).

2. that the contract period depends upon the size of the contract as measured by its cost (estimated contract value).

1. Stipulated contract period.

> "It is often, and becoming prevalent, that a stipulated contract period is the determining factor of the contract value, not an unknown factor to be calculated from an estimated value" (Barnsley, Snell & Partners, Chartered Quantity Surveyors, Private Communication 1983).

This consideration does not require a prediction of time, rather it requires a skill on the part of the design team in designing the project so as to meet the often stringent time limits imposed by the client. The effects of an imposed contract period may, if particularly restrictive, be reflected in the cost of the project. This procedure is sometimes adopted where, for commercial or other reasons, a project is required for occupation on a set date.

This method is not of concern to this research as there is no specific requirement to predict time. The contract period has been pre-determined with the imposition of a completion date by the client.

2. Estimated contract value.

It is this aspect of the time/cost relationship to which this research is addressed. Atkin (1986) found that quantity surveyors are now, more and more, being called upon to give advice on the duration of projects, as well as their costs. The prediction of time, however is often thought to be an ability gained solely through experience.

> "The relationship between time and cost depends solely upon the ability of the people who are in control of the various aspects of the contract. The judgement of this is an art exercised by professional and businessmen, and acquired by experience and intelligence. It cannot be reduced to a statistical model".
>
> (Foster & Emery, Chartered Quantity Surveyors,
> Private Commuinication, 1983)

Research has shown, however, that the prediction of time is possible using statistical models. It is apparent that this non-systematic approach to predicting time is widely used within the profession. The most common approach to time prediction looks at the average amount spent per month and the time taken per 100 square metres of floor area for a few recent contracts and interpolate, extrapolate and average to arrive at an estimate of time. A Study performed by the RICS (1979) found through an analysis of a sample of office buildings that the rate of construction per square metre of gross floor area was 157.5 sq. m. per week. Such estimations are shown to be very unsatisfactory (Bromilow 1969). A more accurate prediction will be made using an applicable systematic method utilizing relevant information thereby predicting time with certain confidence.

The following is a descriptive review of the research undertaken and the resulting methods for predicting time.

## THE BROMILOW MODEL

The Building Research Division of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), under the direction of Dr. F.J. Bromilow, undertook a great deal of research into the problem of time prediction in the late 1960's and 1970's. Their investigations have revealed that for the vast majority of projects, the estimated contract periods initially stated were found to be far below the actual times taken to completle the projects (Bromilow 1969).
It was found that when completed times written into contracts are compared with what is actually happening, it becomes clear that the

main reason why so much excess time appears to be required in some cases is because contract completion times tend to be rather optimistic, rather than because of fundamental differences in time requirements. Bromilow's results show that the writing in construction times known to be inadequate in hopes of spurring the contractor to greater endeavours, has little influence on the time actually taken in practice.

He concluded through his research that "attempts to achieve very short construction periods were generally abortive; no matter how short a time written into the contract, the actual result seems still to be much the same as it would have been anyway." (Bromilow 1969).

Following his research in 1969, Bromilow (1977) identified three stages from inception of the scheme through to practical completion. These are:

i Design and Documentation (pre-tender)

ii Tendering (calling, preparation, submission and evaluation of tenders)

iii Construction (from acceptance of the contractor to the practical completion of the works)

The model produced and explained later in this chapter, is applicable only to stages (i), design and documentation and (iii), construction. For stage (ii), tendering, Bromilow calculates the period based on a range of 30-60 days plus the actual time allowed for tendering.

## Methodology

The Bromilow model is applied using the equation $T=KC^b$. It describes time where,

T = time required in working days

K = a constant describing the general level of time performance for A$1 million project.

C = estimated cost of the project in millions of Australian dollars adjusted to the 1972 cost figure.

b = a constant indicative of the sensitivity of time performance to cost level.

Constants K and b are calculated from the analysis of 309 contracts during the 1969 survey by Bromilow. Time taken is plotted against the final cost of the project. The graphs produced, Figures 1 and 2, relate to stages (i), design and documentation and (iii) construction respectively. They indicate the average performance (line X-X) and the upper and lower quartile limits (marked Q-Q). The graphs are represented using logarithmic scales thus avoiding the overcrowding of the relatively large number of A$10,000 to A$1,000,000 contracts in the lower left hand corner of the figure. Constant b is a measure of the extent to which additional time is taken during construction as the projects get bigger.

The equation $T=KC^b$ is then applied to the stages (i) design and documentation and (iii) construction as follows:

(i) Design and Documentation

$T = KC^b$ where K=270 and b=0.18

$T = 270\ C^{0.18}$

This will give the average time allowance for design and documentation obtaining the constant K from the average line X-X. Should problems be anticipated, then for constant K the upper quartile limit figure Q-Q of 370 should be used.

Similarly, the most reasonable expedited time can be calculated using the lower quartile figure Q-Q of 210 for constant K.

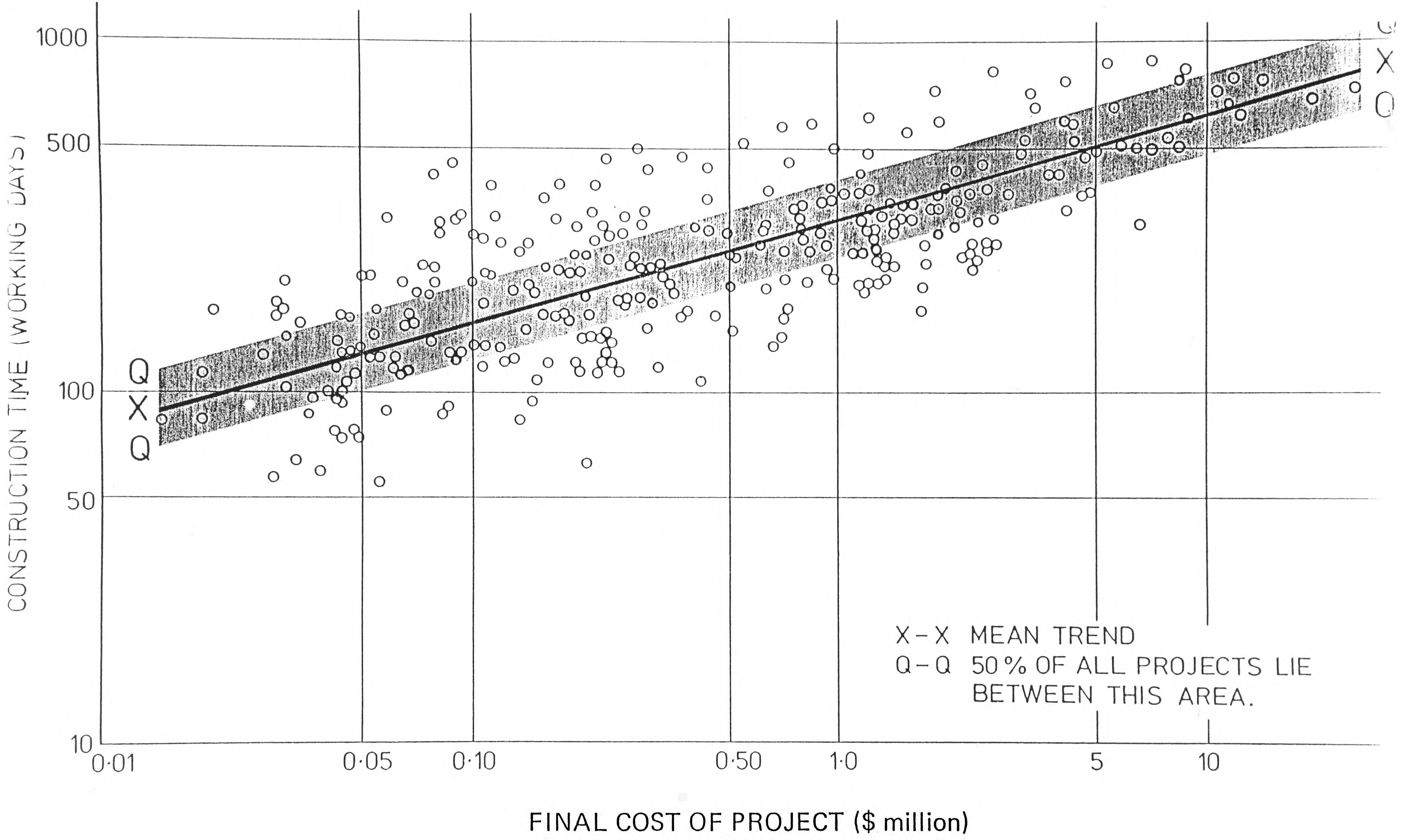

**FIGURE 1**

**Construction time (up to practical completion) as function of cost**
**(Adjusted to labour and material prices at September 1972)**

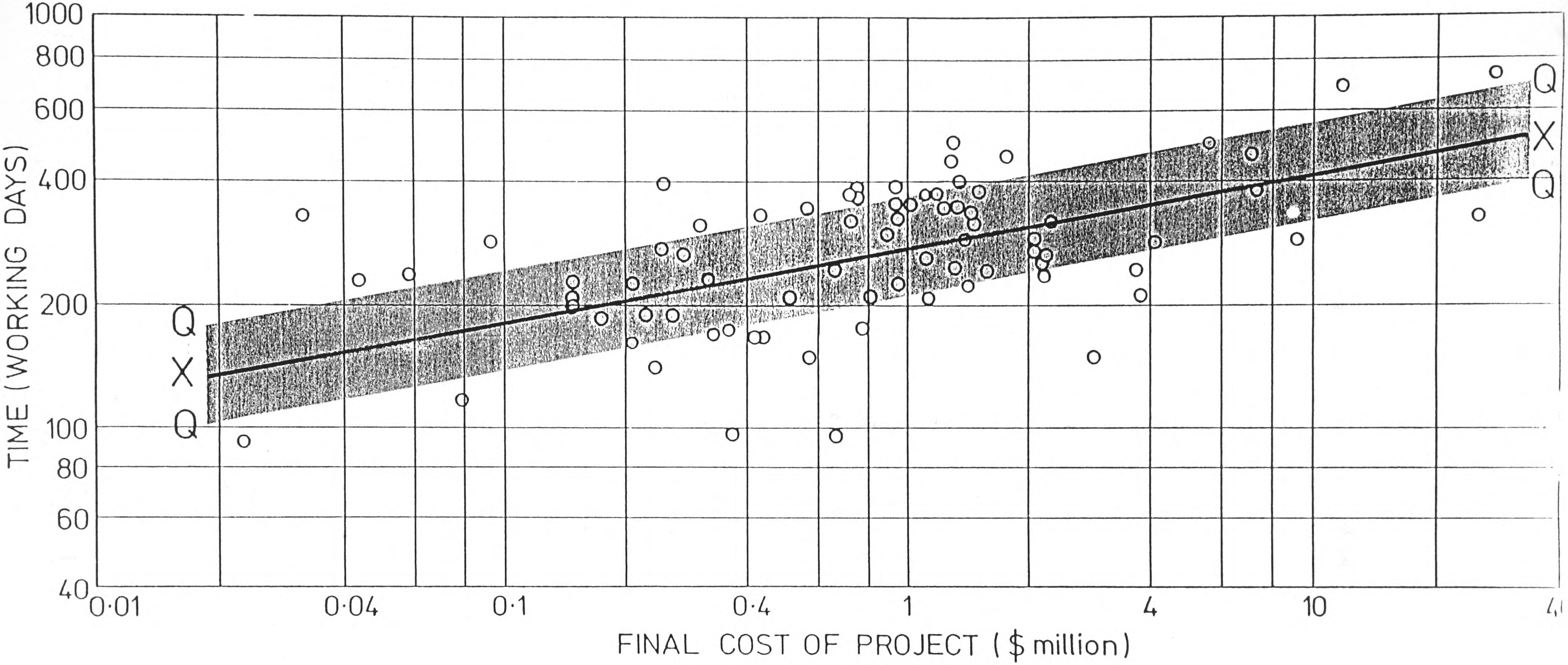

**FIGURE 2**

**Time taken for design and documentation as function of cost**
**(Adjusted to labour and material prices at September 1972)**

(ii) Construction

$T = KC^b$ where $K=313$ and $b=0.30$

$$T = 313\ C^{0.30}$$

This will give the average time allowance for construction obtaining constant K from the average line X-X. Should problems be anticipated then for constant K the upper quartile limit figure Q-Q of 407 should be used. Similarly the most reasonably expedited time can be calculated using the lower quartile figure Q-Q of 250 for constant K.

For some years industry co-operation was sought to monitor the time performance of building contracts on an on-going basis. The task was accepted by the Australian Institute of Quantity Surveryors (AIQS) as a service to the industry as a whole. A committee was formed representing private and government sectors of the AIQS and members of the CSIRO with the objective of investigating the performance of the above model.

The AIQS monitored projects through the period 1970-76 (AIQS, 1980) and during this time a total of 419 projects were surveyed, some 70% being government projects and the remaining 30% being private ones. The results showed that the type of equation reported in 1969 by Bromilow in an attempt to define the industry's actual time performance with regard to construction time, still applied.

The AIQS noted through their monitoring that the constant K made a 16% increase since 1969. It explained this by indicating that projects completed after 1974 would have been affected by the overheated economy of 1973 with its shortages of materials, skilled labour and managerial expertise and its extensive delays arising from disputes on labour matters. The sensitivity factor b remained the same at 0.30 as the time/cost relationship would not have changed through the overheating of the economy.

Bromilow (1971) found that the average amount of time actually absorbed during construction could well be defined as a function of the building cost and that, surprisingly, this function was not sensitive to a particular type of building. The Bromilow model therefore ignored the form of construction, the method of construction, regional price variations and meteorological factors. This may well be the case in Australia but the indications are that in the United Kingdom some, if not all of the above points, have some bearing on the time taken for constructing a project. This research will show which factors are sensitive to predicting time and the relative importance of each of them in that calculation.

## THE HEERY MODEL

Heery (1975) proposed and described a definitive system for time and cost control that can be applied within any given programme of requirements, quality level or design goal. He argues that it is possible for architects, engineers and construction managers to exert a highly acceptable degree of control not only over the cost of building construction but also over the time required for the design and construction process. This time/cost control system has been effectively on a variety of projects both in the United States and throughout the world.

The time/cost control is seen as having strong links with architectural design. Both are indigenous parts of the process which create architecture. The time/cost control system began in the mid 1950's and had been developed as a definable method by 1961. It was seen as a development and improvement upon the traditional design and build method of procurement.

The Heery model (the time/cost control system) involves seven basic components that are either additions to or modifications of the traditional architectural service. These components are:

(a) pre-design project analysis
(b) systems approach to design
(c) an integral cost control system
(d) time control contract provisions
(e) scheduling and information systems
(f) bid and negotiation management
(g) management of contracts and construction

The time/cost control system which comprises the above seven components is merely a structured design and construction management service. The system is simply a series of interrelated procedures that suit the American design/construct process. The system falls into two distinct parts:

(a) - (b) : pre-contract design
(c) - (g) : construction

The system relies on the 'manager' adhering rigidly to each of the components relative to the design or construct stage. The two parts can be considered independently or together.

Time control and project acceleration is accomplished by a series of recommended actions outlined below. These embody the basic philosophy of the time/cost control system.

(1) analyse the client's purchasing power and obtain bids for, or negotiate, construction contracts as required.

(2) identify the constraints relative to site, design, construction, client and any formal approvals.

(3) schedule all design and construction actvities, identifying critical requirements based upon constraints identified under (2), the desired occupancy date or earliest feasible date. Any contingency time for likely extensions should be allowed.

(4) if possible, award early any construction contracts that can be undertaken whilst the design is completed.

(5) avoid any unnecessary phasing of the works.

(6) use procurement methods that are carefully tailored to the individual project and client.

(7) ensure that there is adequate competition whenever bidding is employed.

(8) centralise contract administration via the construction man ager.

(9) be diligent and resourceful throughout.

The constraints in a project (its design, schedule and construction management plan) will determine the feasibility of scheduled beneficial occupancy and final completion dates.

It is a basic concept of the time/cost control system that the construction contract format should always be kept in its simplest and most definitive form. In the United Kingdom, far from becoming simpler, construction contracts are becoming more complex whilst endeavouring to encompass all eventualities.

The Heery time/cost control system has been in existence for more than twenty five years. Its use has been limited to projects controlled by the Heery architectural practice though apparently with success. There has been no independent analysis of the system as used and it's success is only as indicated through the Heery practice. The nearest equivalent system in the UK is the design/build method of procurement. The Heery model does not, in essence, purport to be an all embracing system and it is acknowledged (in step (3) outlined above) that there will inevitably be extensions to the predicted contract period. The time/cost control system does not seem to be specifically concerned with time prediction, rather it appears to be a model for controlling a project.

## THE NOTTINGHAMSHIRE COUNTY COUNCIL MODEL

Nottinghamshire County Council, which is a member of CLASP (Consortium of Local Authorities Schools Programme), have produced a procedural guide to contract periods for basic CLASP construction. This guide forms part of the County Architect's Contract Administration Handbook and is inserted into all CLASP contract documentation.

CLASP follows an industrialised construction system employing standard units developed by the Nottinghamshire County Council. The contracts are let through selective list competition and as such there is an element of experience of the form of construction with an apparent reduction in the resulting construction period. This being so there is seen to be a direct relationship between time and cost.

The following is a guide issued by the clasp to contract periods based upon estimated contract value as applicable in 1983:

| Estimated Contract Value (in pounds) | Contract Period (in months) |
|---|---|
| Not exceeding 75 000 | 4* |
| Exceeding 75 000 not exceeding 100 000 | 5* |
| Exceeding 100 000 not exceeding 150 000 | 6 |
| Exceeding 150 000 not exceeding 200 000 | 6.5 |
| Exceeding 200 000 not exceeding 250 000 | 7 |
| Exceeding 250 000 not exceeding 400 000 | 7.5 |
| Exceeding 400 000 not exceeding 500 000 | 8 |
| Exceeding 500 000 not exceeding 600 000 | 9 |
| Exceeding 600 000 not exceeding 700 000 | 10 |
| Exceeding 700 000 not exceeding 800 000 | 11 |
| Exceeding 800 000 not exceeding 900 000 | 12 |
| Exceeding 900 000 not exceeding 1 000 000 | 13 |
| Exceeding 1 000 000 not exceeding 1 100 000 | 14 |
| Exceeding 1 100 000 not exceeding 1 250 000 | 15 |
| Exceeding 1 250 000 not exceeding 1 500 000 | 16 |
| Exceeding 1 500 000 not exceeding 1 750 000 | 17 |
| Exceeding 1 750 000 not exceeding 2 000 000 | 18 |

* The period between contract signing and date for possession to be of sufficient length to allow materials and components to arrive on site and avoid delays. The short contract period requires the project to be fully designed prior to invitation to tender.

These periods have largely been determined by the delivery periods required by the nominated suppliers for CLASP components. It is acknowledged that these stated periods can only be applied to basic CLASP construction and may require some adjustments. In making any adjustments, considertion should be made of the following:

(1) construction other than CLASP
(2) inclusion of any alteration works
(3) site restrictions/difficulties
(4) high services element
(5) phased working
(6) works comprising several buildings on one site
(7) complexity of the project
(8) extensions to existing buildings
(9) holiday periods
(10) special client requirements
(11) statutory/client restrictions
(12) delivery periods of any special components

Although there is a basic guide to contract periods given, the very nature of construction work and its uniqueness means that for the majority of contracts, at least one of the above will always occur. There is no guidance on additions to the basic period, once again this is left to the discretion of the architect or quantity surveyor.

This guide has apparently been successful and is still in operation. The experience found by the NCC is that it is suitable only for the experienced contractors invited to tender. It appears to be essential that the contractors have an experienced working knowledge of the CLASP construction system in order that they can meet the demanding time schedule imposed on them. Its limitations of use precludes it from being used outside of the CLASP programme.

## SUMMARY

The models identified here each have their own inherent strengths and weaknesses. However, they each identify areas which can be subsequent causes of an increase or a decrease in the contract duration. The Bromilow model is a general one, not restricted to any particular building type or method or procurement though it would appear to be limited to use in Australia. The Heery model is related to a procurement method not dissimilar to the design/build system used in the United Kingdom. It is restrictive and rigid and appears not to have been adopted by the American construction industry nor by the rest of the world. The CLASP model is related to construction method and is restricted only to CLASP developments. It provides a simple time/cost relationship based largely upon experience and feedback taking little account of other factors that may affect time.

The time/cost relationship is a complex one that has attracted few research studies. In each model identified above, cost appears to be the most useful and reliable predictor of time indicating that the hypothesis of cost being a measure of both size and complexity is a valid one. It is with this in mind that cost be the basis for predicting time in the model for this research.

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# CHAPTER FOUR

# TIME PREDICTION - THE SURVEY

# CHAPTER FOUR

# TIME PREDICTION - THE SURVEY

## Introduction

The factors which affect time and the problems of predicting time have been identified in Chapter Two. The objective was to collect sufficient data to produce a reliable statistical analysis. The success of the research would depend largely upon the co-operation of the practising professional quantity surveyor. There are, amongst others, two large organisations which maintain a comprehensive data bank on the cost and time of construction projects. These are the Milton Keynes Development Corporation (MKDC) and the Building Cost Information Services (BCIS) of the Royal Institution of Chartered Surveyors (RICS). If the survey did not produce sufficient data then it would be necessary to supplement the survey data with additional data from the MKDC and the BCIS. These two organisations both gave their approval to this support though in the event it did not prove necessary to supplement the data.

## The Pilot Survey

It was decided to attempt to collect the data through the use of a questionnaire. This was considered to be the most economic use of resources available. As is common with the use of questionnaires, it was decided first to test the form in the field before conducting the survey proper. Should it prove to be successful at the first attempt, then the pilot survey would provide a proportion of the total data used; if not, then it would save a lot of wasted time.

In designing the pilot survey questionnaire, a number of psychological factors were employed:

(a) It was considered important to keep the questionnaire as brief as possible, thus acknowledging the importance of the maxim 'time is money' in a professional office.

(b) The optimum physical size would be one sheet of A4 sized paper, with all the questions being self-explanatory, thus eliminating the need for an introductory sheet.

(c) Recognising that this was a pilot survey, an opportunity was given for the recipient to comment on the format of the questionnaire.

After several attempts, the attached questionnaire (Figure 3) was produced. A word processor was employed to produce a personal letter to accompany the questionnaire. As an incentive to respond, each practice was informed that they would receive a brief report outlining the findings of the research and that subsequently, should any computer software become available, they would be notified in advance.

Title of Research: THE INTER-RELATIONSHIP BETWEEN TIME AND COST FOR CONSTRUCTION PROJECTS.

| CONFIDENTIAL INFORMATION | FOR OFFICE USE |
|---|---|
| Name of Office:................... | Reference No. :....... |
| Address :................... | Categorisation:....... |
| ................... | Processed :....... |
| ................... | |
| Date :................... | |

PLEASE SUPPLY ANSWERS TO ALL QUESTIONS AS INDICATED circling as appropriate (Please complete in black ink)

| | |
|---|---|
| 1. TYPE OF PROJECT (not the name). | 1. Residential...........H<br>Commercial............C<br>Industrial............I<br>Educational...........E<br>Recreational..........R<br>Other(please state).....<br>...................... |
| 2. CONTRACT VALUE (as at start of contract - minimum value £100,000) | 2. ..................pounds |
| 3. ORIGINAL CONTRACT PERIOD. | 3. ...................weeks |
| 4. FINAL CONTRACT PERIOD. | 4. ...................weeks |
| 5. DATE WORK COMMENCED ON SITE. | 5. ......... |
| 6. BASE DATE FOR COST DATA. | 6. .../.... |
| 7. LOCATION. | 7. ..............town/city<br>..................county |
| 8. FORM OF CONTRACT USED. | 8. JCT Private with......PQ<br>JCT Private without....P<br>JCT LA with...........LQ<br>JCT LA without.........L<br>Other(please state).....<br>...................... |
| 9. BASIS OF TENDER | 9. Firm price............F<br>Fixed price...........Fp<br>Fluctuating...........Fl |
| 10.CLIENT BODY. | 10.Private...............Pr<br>Developer............De<br>Local Authority.......LA<br>Central Government....CG<br>Other..................<br>...................... |

COMMENTS:

Figure 3.: Questionnaire Format for the Pilot Study

The pilot survey then was initiated to:

(a) test whether or not the questionnaire worked as expected and

(b) test the response to the request for suitable data.
One hundred questionnaires were sent out to twenty practices, each receiving five questionnaires.
The names and addresses of the practices were selected from the then current RICS Year Book. This is an Institution publication giving a comprehensive list of members in practices throughout the world.
In selecting the practices, at least one name came from each region, as categorised by the RICS, of the British Isles. None were sent overseas as the data was to be based on the British Isles only. All questionnnaires were sent out by post within a period of one week.

The response to the pilot survey was encouraging, if not somewhat surprising at 80% return within two months of posting. These questionnaires were analysed and the following points raised:

(a) in testing the response, it appeared that this method was an excellent one for collecting the data;

(b) not all partners completed the "name and address" portion. This might be either that the questionnaire is not explicit enough, or that the practice preferred to remain anonymous.

(c) from the questions asked, it was not always possible to determine the reasoning behind the data given.

(d) various comments were noted on the research. Such comments include:

> "Your questionnaires have been completed in full without an awful lot of difficulty, but I do feel that the matter will require consideration of certain other facts which do not come to light in the questionnaires."
>
> "As you did not suggest any sampling procedure, I have taken the six most recently completed contracts with a contract value in excess of £100 000".
>
> "You have stressed that you are basing your data on the original contract value but I would have thought the final value to be more appropriate."

It was decided, therefore, that before the survey proper be attempted, certain amendments had to be made to both the questionnaire and the letter. The following changes were incorporated:

(i) all parts of the form requiring answers were to be given a question number. In this way it was hoped that the 'name and address' section would be completed.

(ii) an additional question should be asked to establish the cause of delay, if any.

(iii) the letter should be more precise in terms of the research intentions.

## The Survey Proper

The final questionnaire (Figure 4) and accompanying letter (Figure 5) were produced, account having been taken of the points raised above. It was decided again to have a mail shot to quantity surveying practices selected regionally, at random, from the RICS Year Book. It was expected that there would be a similar rate of return.

One thousand questionnaires were mailed within one month. As in the pilot survey, five questionnaires were sent to each practice. The rate of reply was initially good, leading to an expected rate of return in the region of 80%, but this unfortunately rapidly tailed off. A reminder letter (Figure 6) was sent to those practices who had not replied after two months.

After a period of four months, 212 completed questionnaires had been returned. This was disappointing following the successful pilot survey, but at 21% the rate of return was more than could be expected from a postal survey. It was decided that this number of questionnaires provided sufficient data to commence the analysis. Any late returned questionnaires could easily be incorporated into the analysis. In the event no further questionnaires were received.

Title of Research: THE INTER-RELATIONSHIP BETWEEN TIME AND COST FOR CONSTRUCTION PROJECTS.

PLEASE SUPPLY ANSWERS TO ALL QUESTIONS AS INDICATED (Please write in block capitals or use a typewriter).

1. Name of Office:..............................
Address :..............................
..............................
..............................
..............................
Date :...............

| | |
|---|---|
| 2. TYPE OF PROJECT (not the name). | 2. Residential............H<br>Commercial.............C<br>Industrial.............I<br>Educational............E<br>Recreational...........R<br>Other(please state).....<br>........................ |
| 3. CONTRACT VALUE (as at start of contract - minimum value £100,000) | 3. £.......... |
| 4. ORIGINAL CONTRACT PERIOD. | 4. ............weeks/months |
| 5. FINAL CONTRACT PERIOD. | 5. ............weeks/months |
| 6. ADDITIONAL WORK AUTHORISED WITH EXTRA TIME AND VALUE. | 6. ............weeks/months<br>£....... |
| 7. SUGGESTED CAUSE OF DELAY. ( If applicable) | 7. Inclement weather.....IW<br>Delay in drawing issue.D<br>Bankruptcy.............B<br>Strikes................S<br>Labour/materials shortage...........LM<br>Other................... |
| 8. DATE WORK COMMENCED ON SITE. | 8. .../../.... |
| 9. BASE DATE FOR COST DATA. | 9. .../.... |
| 10.LOCATION. | 10................town/city<br>..................county |
| 11.FORM OF CONTRACT USED.(eg JCT 80 Private with Quantities) | 11.State exact form used...<br>........................ |
| 12.CLIENT BODY. | 12.Private...............Pr<br>Developer.............De<br>Local Authority.......LA<br>Central Government....CG<br>Other..................<br>........................ |
| 13.BRIEF DESCRIPTION OF PROJECT: indicate the number of units,any abnormal inclusions and/or exclusions etc. | 13.......................<br>........................<br>........................<br>........................ |

Figure 4.: Questionnaire Format Used in the Survey Study.

INM/RL1/PQS
517
3rd February 1983

Dear

As you are no doubt aware from recent articles in the quantity surveying press, the ultimate cost of the project is the all important figure that the client wishes to know. One major factor contributing to increased costs during the running of the contract, is an inaccurate estimation of the contract period. I am writing to you today to seek your support in a research project that I am undertaking to study the inter-relationship of time and cost for construction projects.

Briefly, I am trying to establish the relationship between time, in terms of contract period, and cost, this being the contract value, taking into account any contributory factors that become apparent. From the information received, a statistical model will be formulated to accurately predict the contract period using the estimated contract value. Ultimately, it is hoped that this model will form the basis of a piece of software to be used on micro-computers which are becoming more common in Quantity Surveying offices.

Could I therefore ask you if you could spare the time to complete the five questionnaires enclosed.Once completed, I would like them to be returned to me at the above address. I would stress that I do NOT wish to know the actual project name or that of the Main Contractor. This does not aid me and will only serve to breach the confidentiality between the client and the quantity surveyor.

I hope that you are able to help, but should you wish to discuss the matter further before returning the forms, then I would be pleased to hear from you. I would point out that the information will of course be kept in the strictest confidence. You will be entitled to a copy of the report, when published, and you will be notified of the sale of any anticipated software. I should be most grateful to have the completed forms as soon as possible.

Yours sincerely,

I.N. MEHRTENS B.Sc, ARICS.
Senior Lecturer in Quantity Surveying

**Figure 5.: The Accompanying Letter to the Questionnaires.**

INM/RL2/PQS
517
5th April 1983

Dear

You may recollect that I wrote to you at the beginning of the year with a request for help on a research project that I am undertaking at Thames Polytechnic into the inter-relationship between time and cost for construction projects. The request was for the completion of five questionnaires.

Looking at the responses to my request, I have noticed that I have not, as yet, received any reply from your practice. I realise that you are obviously very busy and that time is of a premium in any practice, but as I am sure you will appreciate, the success of this study depends entirely on the willingness and participation of the profession. I would stress again, that we do NOT wish to know any names; this information will not help us in our research and will only serve to breach the confidentiality between the contractor and the quantity surveyor.

Briefly, to remind you of the purposes and eventual aims of my work, I am trying to establish the relationship between time, in terms of contract period, and cost, this being the contract value, taking into account any contributory factors that become apparent. From the information received, it is anticipated that a statistical model will be formulated to accurately predict the contract period using the estimated contract value. Ultimately, it is hoped that this model will be the basis of a piece of software to be used on micro-computers which are becoming more common in quanitity surveying practices.

Could I therefore please ask for your assistance and hope that you find the time to complete the five questionnaires enclosed. Should you wish to discuss the matter further before returning the forms, then I would be pleased to hear from you. It ought to be pointed out that the information you will give will of course be kept in the strictest confidence. You will be entitled to a copy of the report, when published, and you will ne notified of the availability of any anticipated software.

I should be most grateful to have your completed forms as soon as possible, a pre-paid envelope is enclosed for your reply.

Yours sincerely,

I.N.Mehrtens B.Sc ARICS.
Senior Lecturer in Quantity Surveying.

**Figure 6.: The Follow Up Reminder Letter.**

Upon initial inspection of the questionnaires, it appeared that a wide range of building types had been submitted, so it ws decided that it would be advantageous at this stage to categorise the data into broad functional areas. A range of categorisations are available such as the CI/SfB. It was decided to adopt a simple functional system that could easily be identified and categorised without requiring any interpretation. The categories chosen were as follows:

H : housing or any other domestic dwelling
C : commercial properties
I : industrial units
E : educational buildings
R : recreational buildings
M : medical centres
T : transport buildings
S : sundry - any other buildings that could not be categorised above.

The number of projects returned and allocated to the categories above are as given in Figure 7 below:

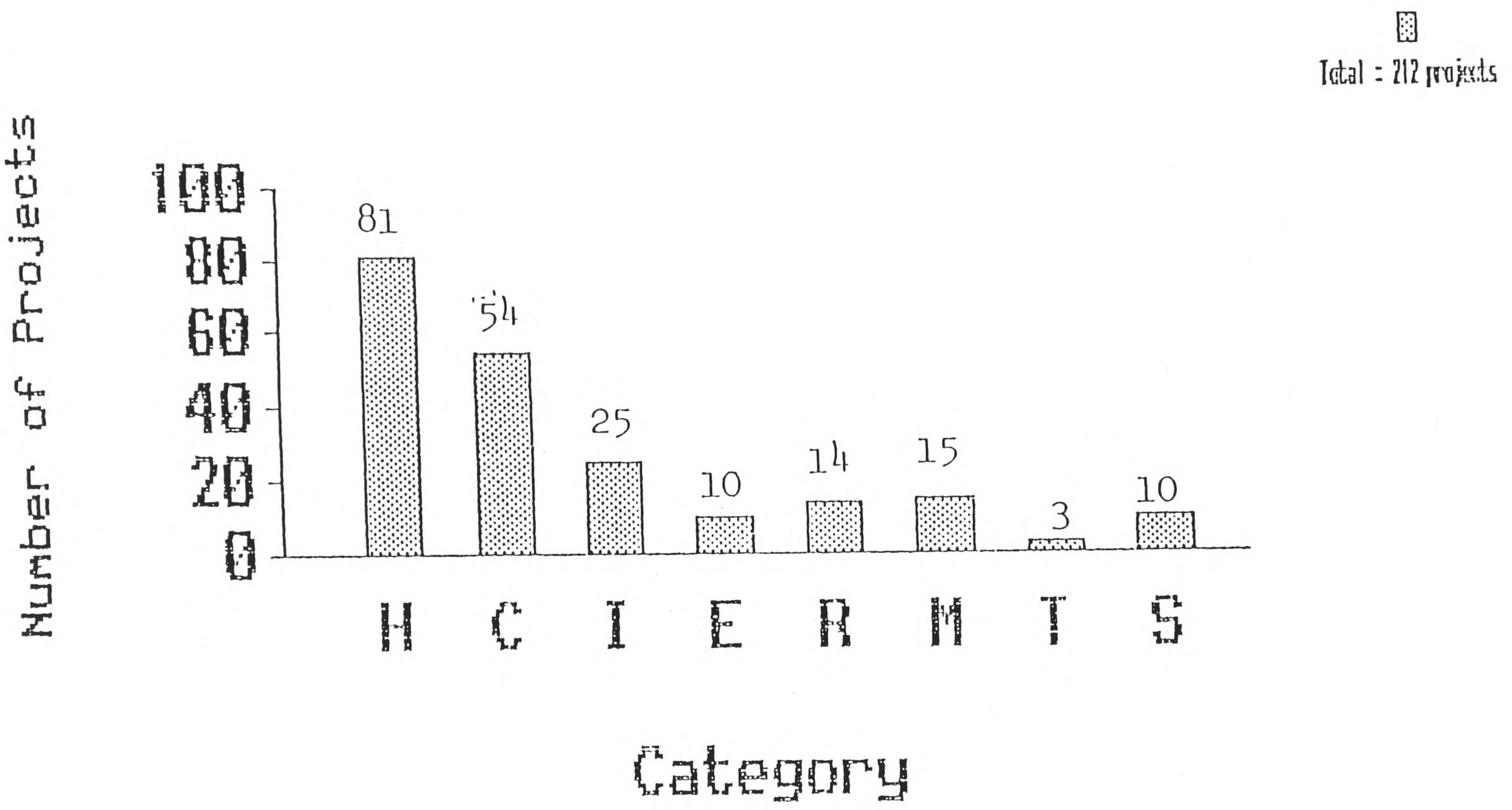


Figure 7 : Type of Project

It can be seen from Figure 7 that there was a wide range in the numbers of projects returned within each of the categories from T (transport) at 3 (1.5%) to H (housing) at 81 (38%). This range is much as could be expected from a random survey.

## Multiple regression analysis

The aim of this reasearch is to be able to predict time using the estimated cost as the basis for that calculation. If the relationship was that simple, there would be no deviation from the stated contract period. Research has shown that this is not the case, suggesting that this simple relationship is not valid. Bromilow (1969) found that there was a linear relationship between time and cost but that this was subject to a constant describing the general level of time performance.

Multiple regression is a technique used successfully to establish interrelationships among large numbers of variables in a single set of previously undigested data. The advantage of multiple regression is that it shows both the combined effects of a set of independent variables and the separate effects of each independent variable.

Multiple regression assumes that the effects of the independent variables are linear: that is the effect of a unit difference in an independent variable is the same at all points in the range of the variable. In order to measure the extent, or strength, or the linear relationship, the correlation coefficient can be calculated.

If r = +1 (-1) then there is complete positive (or negative) linear correlation. If r=0 then there is no linear correlation. In general terms the nearer the value of r is to +1 or -1, then the stronger is the linear relationship.

A multiple linear regression model is adopted for the analysis of the relationship between the duration of time for completing the project as the response variable and those variables affecting the response as the regressors. If we denote the response variable by Y and the regressors as X1, X2,..... Xk then the model can be written as:

$$Y = B1 + B1X1 + B2X2 + .......+ BkXk + E$$

where E is assumed to be an independent random error having a normal distribution with zero mean and some constant variance. The B's are constants whose values are estimated by the method of least squares. The least squares estimates of the B's are determined on the basis of the criterion that these estimates make the sum of squares of the error term E a minimum.

With so many variables in the equation, the choice of regression equation became significant. It had been estimated that the questionnaires would produce at least ten variables, each of which could significantly affect the time factor.

The choice of selecting the best regression equation is therefore critical to the success of the analysis. Two opposed criteria are usually involved in this selection process:

(a) to make the equation useful for predictive purposes, it is desirable to use as many variables as possible so that reliable values can be determined.

(b) because of the methods involved in obtaining information on a large number of variables and subsequently monitoring them, it is desirable to include as few variables as possible in the equation.

The compromise between these two extremes is what is usually called 'selecting the best regression equation'. There is no unique procedure for doing this and personal judgement plays a large part in the selection process.

The following procedures were examined:

(1) Backward Elimination Procedure

This method attempts to permit the examination of only the "best" regression containing a certain number of variables. The basic steps are as follows:

(a) a regression equation containing all the variables is computed.

(b) the partial F-test value is calculated for every variable as though it were the last variable to enter the equation.

(c) the lowest partial F-test value (Fl) is compared with a preselected percentage point (FO).

(i) If Fl < FO, then that variable is removed from consideration and the regression equation is recomputed in the remaining variables.

(ii) If Fl > FO, then the regression equation calculated is adopted.

### (2) Forward Selection Procedure

The previous method begins with the largest regression, using all variables and subsequently reduces the number of variables in the equation until a satisfactory decision is reached. The forward selection procedure is an attempt to achieve a similar conclusion working from the opposite direction.

The order of insertion of the variables is determined by using the partial correlation coefficient as a measure of the importance of variables not yet in the equation. As soon as the partial F-value related to the most recently entered variable becomes non-significant, the process is terminated.

### (3) Stepwise Regression Procedure

This is a combination of the backward and forward procedures. The improvements made involve the re-examination at every stage of the regression of the variables incorporated into the model at previous stages.

> A variable which may have been the best single variable to enter at an early stage may, at a later stage, be superfluous because of its relationships with other variables now in the equation. Any variable which provides a non-significant contribution is removed from the model. This process is continued until no more variables will be admitted to the equation and no more are rejected.

Examining the three available procedures it is clear that for this research the stepwise regression procedure will provide the best fit solution. The characteristic considered most important is that of re-examining all variables for significance at every step, a feature that does not exist in either of the other procedures. For this reason it was decided to apply the stepwise regression procedure to the data collected. The results contained in chapters five and six are those produced using this facility within the computer programme Statistical Package for Social Scientists (SPSS). This package is a set of programmes that enables a variety of statistical analyses to be made quickly and accurately.

The questionnaires allowed for the full range of project types in that none were specifically excluded. As some project category groupings had relatively few returns, and with so many variables in the equation, it was necessary to combine some groups to create the files for use in the SPSS regression analysis. At this stage there was no evidence to suggest that each project type would react differently. If the results of the grouped files suggested that they did, then it would be necessary to separate the types again and re-examine the groupings. The files created are as follows:

| | | |
|---|---|---|
| 1. | Residential | 38% |
| 2. | Commerical | 25% |
| 3. | Remainder | 37% |
| 4. | All combined | 100% |

The description and analysis of data is provided in Chapter Five and where it will be seen that it was not necessary to re-examine the groups as there was a large degree of commonality in the results.

# CHAPTER FIVE

# TIME PREDICTION - AN ALTERNATIVE APPROACH

# DESCRIPTION OF DATA

## Introduction

An analysis of the questionnaires shows that there are a number of variables that were required to be included in the regression. It is the purpose of this research to show, through the regression analysis, which if any, of the variables identified affect the time/cost relationship and to what extent. It was realised in preparing these variables for inclusion in the regression annalysis that while some were quantitative, others were qualitative (indicated below by *). Where the variable is quantitative, no problem exists in that the value label attached will be the quantity recorded. The same theory cannot be applied to the qualitative variables. It was decided to adopt a binary coding with 0 indicating a category of the variable not being present and 1 indicating the category being present. The following variables were identified from the questionnaires and labelled ready for inclusion in the stepwise regression package within the SPSS programme.

| | |
|---|---|
| Final Contract Period | FCP |
| Type of Work | TOW * |
| Client Body | CLIENT * |
| Form of Contract | FOC * |
| Type of Contract | TOC * |
| Geographical Location | LOCTN * |
| Date Work Started | DWS * |
| Adjusted Original Contract Value | AOCV |
| Adjusted Additional Contract Value | AACV |
| Causes of Delay | A B C D E * |

## FINAL CONTRACT PERIOD (FCP)

The FCP is represented numerically in weeks. This is not the original contract period as stated in the contract documentation, but is the actual time that the contract took to complete. The value labels attached are the number of weeks taken for the contract to be completed. (C1)

## TYPE OF WORK (TOW)

Here it is intended to indicate whether the project is new work or refurbishment of an existing property. Within the industry, it is believed that refurbishment work takes longer to complete than anticipated. The value labels attached are as follows:

(C2)

0 = New work

1 = Refurbishment

CLIENT BODY (CLIENT)

Here an attempt is being made to classify the client into the broad terminology of commercial or quasi/non-commercial. This will give an indication of profit making motivation and may have some relationship to the time taken for construction. The value labels attached are as follows:

C3.....C7

0 0 0 0 0 = Private

1 0 0 0 0 = Developer

0 1 0 0 0 = Local Authority

0 0 1 0 0 = Central Government

0 0 0 1 0 = Housing Association

0 0 0 0 1 = Other

## FORM OF CONTRACT (FOC)

With a wide range of standard forms of contract available, it is anticipated that this might have an influence on the time/cost relationship. The reasons why there are so many forms of contract available are that they are all designed to meet particular contractual requirements and it has been shown that the wrong choice of contract can have a detrimental effect on client time. The value labels attached are as follows:

C8..........C15
0 0 0 0 0 0 0 0 = LA Edition with quantities
1 0 0 0 0 0 0 0 = LA Edition without quantities
0 1 0 0 0 0 0 0 = Private Edition with quantities
0 0 1 0 0 0 0 0 = Private Edition without quantities
0 0 0 1 0 0 0 0 = Fixed Fee
0 0 0 0 1 0 0 0 = Fluctuating Fee
0 0 0 0 0 1 0 0 = Management Design and Build
0 0 0 0 0 0 1 0 = GC/Works/1
0 0 0 0 0 0 0 1 = Other

## TYPE OF CONTRACT (TOC)

It is thought that depending upon the way in which increased costs are recovered, there may be an incentive to complete early or to delay. The value labels attached are as follows:

C16

0 = Fixed costs

1 = Fluctuating costs

GEOGRAPHICAL LOCATION (LOCTN)

An attempt is being made here to determine whether a pattern emerges for any particular region of the UK. Depressed regions, where work is not readily available, may harbour greater incentives to complete projects 'on time', with the hope that more work may follow. The value labels attached are as follows:

C17................C28

0 0 0 0 0 0 0 0 0 0 0 0 = Northern

1 0 0 0 0 0 0 0 0 0 0 0 = Yorkshire & Humberside

0 1 0 0 0 0 0 0 0 0 0 0 = East Midlands

0 0 1 0 0 0 0 0 0 0 0 0 = East Anglia

0 0 0 1 0 0 0 0 0 0 0 0 = South East

0 0 0 0 1 0 0 0 0 0 0 0 = London

0 0 0 0 0 1 0 0 0 0 0 0 = SE Counties

0 0 0 0 0 0 1 0 0 0 0 0 = Southern Counties

0 0 0 0 0 0 0 1 0 0 0 0 = South West

0 0 0 0 0 0 0 0 1 0 0 0 = West Midlands

0 0 0 0 0 0 0 0 0 1 0 0 = North West

0 0 0 0 0 0 0 0 0 0 1 0 = Wales

0 0 0 0 0 0 0 0 0 0 0 1 = Scotland

## DATE WORK STARTED (DWS)

The seasonal effect of building is well documented. The date work starts on site is categorised here into half years:

C29

1 = Summer season (April - September)

2 = Winter season (October - March)

## ADJUSTED ORIGINAL CONTRACT VALUE (AOCV)

The original contract value is the agreed value at the time of signing the contract. Upon examination of the questionnaires, it appeared that all analysed contract values fell within the range of £100 000 - £4 000 000. To analyse the values, it is necessary to bring all cost to a common base using indices. It was decided to use the BCIS Tender Price Index adjusted to the 4thQ 1977. The adjusted date is irrelevant in that the actual adjusted cost is not important - it is the way in which the cost reacts to the variables being applied. The indices used are given below.

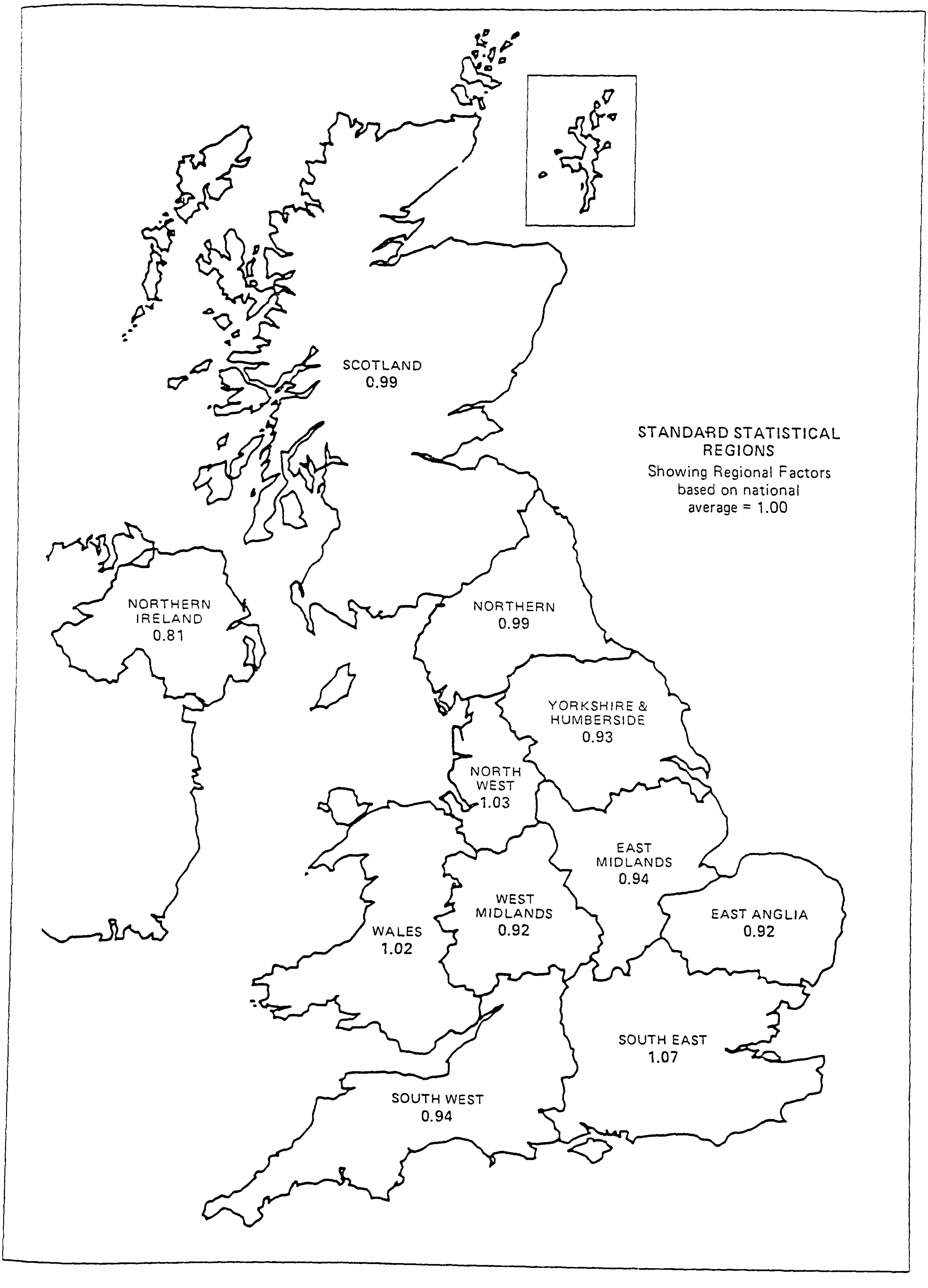
Index Base: 1st Quarter 1974

| Quarter | | Tender Price Index |
|---|---|---|
| 1974 | i | 100 |
| | ii | 100 |
| | iii | 99 |
| | iv | 100 |
| 1975 | i | 105 |
| | ii | 103 |
| | iii | 105 |
| | iv | 105 |
| 1976 | i | 111 |
| | ii | 109 |
| | iii | 113 |
| | iv | 116 |
| 1977 | i | 120 |
| | ii | 130 |
| | iii | 133 |
| | iv | 129 |

|  |  |  |
|---|---|---|
| 1978 | i | 137 |
|  | ii | 146 |
|  | iii | 154 |
|  | iv | 160 |
| 1979 | i | 172 |
|  | ii | 179 |
|  | iii | 199 |
|  | iv | 212 |
| 1980 | i | 214 |
|  | ii | 226 |
|  | iii | 227 |
|  | iv | 214 |

The cost of a building is also affected by its location. In bringing all costs to a common base, it is recognised that some factor must be applied to take account of the variance due to location. Once again it was decided to use the BCIS and in particular the Location factors as published. The following location factors are based on a national average = 1.00 and are derived upon analysis of all the tender prices calculated over the period 1975 - 1980. (See Figure 8.)

Figure 8 Regional Factors



|  |  |
|---|---|
| Northern | 0.99 |
| Yorkshire & Humberside | 0.93 |
| East Midlands | 0.94 |
| East Anglia | 0.92 |
| South East | 1.07 |
| London | 1.07 |
| Southern Counties | 1.07 |
| South West | 0.94 |
| West Midlands | 0.92 |
| North West | 1.03 |
| Wales | 1.02 |
| Scotland | 0.99 |

The AOCV therefore takes account of both the time difference and the location. The value labels attached are the actual figures as calculated. (C30)

## ADJUSTED ADDITIONAL CONTRACT VALUE (AACV)

It was realised that in many projects, the client authorises additional spending on the contract. This extra spending often results in an additional time requirement. As with the original contract value, adjustments for time and location also had to be made. The value labels attached are the actual figures as calculated. (C31)

CAUSES OF DELAY (A B C D E )

It has been suggested that many contracts are subject to delays. The questionnaire attempts to identify the causes of these delays and to reconcile the discrepancy between original and final contract periods. The value labels attached are as follows:

(C32..C35)

0 0 0 0 = Inclement weather

1 0 0 0 = Delay in drawing issue

0 1 0 0 = Bankruptcy

0 0 1 0 = Strikes

0 0 0 1 = Labour/Material shortages

The questionnaires allowed for the full range of project types in that none were specifically excluded. There seemed no evidence to suggest that they would react to the analysis in differing ways. It was decided to categorise into project types initially to identify the category of data. The distribution is as follows:

| | |
|---|---|
| Housing | 81 |
| Commerical | 54 |
| Industrial | 25 |
| Educational | 10 |
| Recreational | 14 |
| Medical | 15 |
| Transport | 3 |
| Sundry | 10 |
| TOTAL | 212 |

As a number of the project types have very small amounts of data it was decided to create four files based purely on a random numerical assessment. The files created are as follows:

| | | | |
|---|---|---|---|
| 1. | Residential | 81 | (38%) |
| 2. | Commercial | 54 | (26%) |
| 3. | Remainder | 77 | (36%) |
| 4. | All combined | 212 | (100%) |

Using the SPSS package, the data was input within the confines of the pre-established variable labels identified earlier in this chapter. The following, Figures 9,10 and 11, are copies of the completed questionnaires for the Transport category which form the basis for the input data for File 3 (Remainder). The names and addresses have been omitted from the copies to maintain the confidentiality promised to contributors of data for this research.

# Title of Research: THE INTER-RELATIONSHIP BETWEEN TIME AND COST FOR CONSTRUCTION PROJECTS.

PLEASE SUPPLY ANSWERS TO ALL QUESTIONS AS INDICATED (Please write in block capitals or use a typewriter).

---

1. Name of Office:...........................
Address :...........................
...........................
......PROJECT 1.............
...........................
Date :..............

| | |
|---|---|
| 2. TYPE OF PROJECT (not the name). | 2. Residential............H<br>Commercial.............C<br>Industrial.............I<br>Educational............E<br>Recreational...........R<br>Other(please state).....<br>...TRANSPORT........... |
| 3. CONTRACT VALUE (as at start of contract - minimum value £100,000) | 3. £297 709... |
| 4. ORIGINAL CONTRACT PERIOD. | 4. .20.........weeks/~~months~~ |
| 5. FINAL CONTRACT PERIOD. | 5. .40½........weeks/~~months~~ |
| 6. ADDITIONAL WORK AUTHORISED WITH EXTRA TIME AND VALUE. | 6. ..7½........weeks/~~months~~<br>£34 828. |
| 7. SUGGESTED CAUSE OF DELAY. ( If applicable) | 7. Inclement weather.....[✓ IW]<br>Delay in drawing issue.D<br>Bankruptcy.............B<br>Strikes................[✓ S]<br>Labour/materials shortage...........LM<br>Other.................. |
| 8. DATE WORK COMMENCED ON SITE. | 8. .15/.1/.79. |
| 9. BASE DATE FOR COST DATA. | 9. NOV/.78. |
| 10. LOCATION. | 10. .LONDON........town/city<br>..................county |
| 11. FORM OF CONTRACT USED.(eg JCT 80 Private with Quantities) | 11. State exact form used...<br>**JCT 63 LA with Quants...** |
| 12. CLIENT BODY. | 12. Private...............Pr<br>Developer.............De<br>Local Authority......[✓ LA]<br>Central Government....CG<br>Other.................<br>..................... |
| 13. BRIEF DESCRIPTION OF PROJECT: indicate the number of units, any abnormal inclusions and/or exclusions etc. | 13 **Passenger & staff accomm at 5 No railway stations (stations kept in operation throughout)** |

---

Figure 9

## Title of Research: THE INTER-RELATIONSHIP BETWEEN TIME AND COST FOR CONSTRUCTION PROJECTS.

PLEASE SUPPLY ANSWERS TO ALL QUESTIONS AS INDICATED (Please write in block capitals or use a typewriter).

---

1. Name of Office:...........................
   Address :...........................
   ...........................
   .....PROJECT 2..............
   ...........................
   Date :..............

| | |
|---|---|
| 2. TYPE OF PROJECT (not the name). | 2. Residential............H<br>Commercial.............C<br>Industrial.............I<br>Educational............E<br>Recreational...........R<br>Other(please state).....<br>......TRANSPORT......... |
| 3. CONTRACT VALUE (as at start of contract - minimum value £100,000) | 3. £9 048 686. |
| 4. ORIGINAL CONTRACT PERIOD. | 4. ...25.......~~week~~s/months |
| 5. FINAL CONTRACT PERIOD. | 5. ...27.......~~week~~s/months |
| 6. ADDITIONAL WORK AUTHORISED WITH EXTRA TIME AND VALUE. | 6. ....2.......~~week~~s/months<br>£...-... |
| 7. SUGGESTED CAUSE OF DELAY. ( If applicable) | 7. Inclement weather.....IW<br>Delay in drawing issue.D<br>Bankruptcy.............B<br>Strikes................S<br>Labour/materials shortage...........LM<br>Other................... |
| 8. DATE WORK COMMENCED ON SITE. | 8. .1./.6/.80. |
| 9. BASE DATE FOR COST DATA. | 9. MAR/.80. |
| 10.LOCATION. | 10.ROTHERHAM......town/city<br>..S.Yorks.........county |
| 11.FORM OF CONTRACT USED.(eg JCT 80 Private with Quantities) | 11.State exact form used...<br>JCT 63 LA with Qaunts... |
| 12.CLIENT BODY. | 12.Private...............Pr<br>Developer.............De<br>Local Authority......[✓ LA]<br>Central Government....CG<br>Other...................<br>........................ |
| 13.BRIEF DESCRIPTION OF PROJECT: indicate the number of units,any abnormal inclusions and/or exclusions etc. | 13.Parking for 180 buses & workshops, admin and ancillicary buildings<br>........................ |

---

Figure 10

## Title of Research: THE INTER-RELATIONSHIP BETWEEN TIME AND COST FOR CONSTRUCTION PROJECTS.

PLEASE SUPPLY ANSWERS TO ALL QUESTIONS AS INDICATED (Please write in block capitals or use a typewriter).

---

1. Name of Office:..............................
Address :..............................
..............................
.......PROJECT 3.............
..............................
Date :...............

| | |
|---|---|
| 2. TYPE OF PROJECT (not the name). | 2. Residential............H<br>Commercial............C<br>Industrial............I<br>Educational............E<br>Recreational...........R<br>Other(please state).....<br>VEHICLE MAINT GARAGE.... |
| 3. CONTRACT VALUE (as at start of contract - minimum value £100,000) | 3. £226 142... |
| 4. ORIGINAL CONTRACT PERIOD. | 4. ....6.......~~weeks~~/months |
| 5. FINAL CONTRACT PERIOD. | 5. ....7.......~~weeks~~/months |
| 6. ADDITIONAL WORK AUTHORISED WITH EXTRA TIME AND VALUE. | 6. ...NIL......~~weeks~~/months<br>£....... |
| 7. SUGGESTED CAUSE OF DELAY. ( If applicable) | 7. Inclement weather.....IW<br>Delay in drawing issue.D<br>Bankruptcy.............B<br>Strikes................S<br>Labour/materials shortage...........LM<br>Other.................. |
| 8. DATE WORK COMMENCED ON SITE. | 8. .15/.9/.80. |
| 9. BASE DATE FOR COST DATA. | 9. .../....FIXED PRICE |
| 10.LOCATION. | 10.BIRMINGHAM.....town/city<br>..................county |
| 11.FORM OF CONTRACT USED.(eg JCT 80 Private with Quantities) | 11.State exact form used...<br>JCT 63 LA with Quants... |
| 12.CLIENT BODY. | 12.Private...............Pr<br>Developer.............De<br>Local Authority.......LA<br>Central Government...[✓ CG]<br>Other..................<br>...................... |
| 13.BRIEF DESCRIPTION OF PROJECT: indicate the number of units,any abnormal inclusions and/or exclusions etc. | 13.Alteration and completion of warehouses to form vehicle maintenance garage |

---

Figure 11

## ANALYSIS OF DATA

### Introduction

Initially the regression was perfomed on three sets of data, Files 1, 2 & 3 (Residential, Commerical and Remainder respectively). The output from these three files was then analysed to determine any commonality of findings. As will become apparent later in this chapter, there being some apparent degree of commonality, it was decided to perform the regresssion analysis on File 4, All Combined. the output from this file then formed the basis for determining the regression equation and identifying the significant variables affecting the prediction of time. The output is presented in Appendix A to this thesis.

The data presented here shows for each regression analysis performed, the significant variables in the order in which they appear with their relative values. Beyond the step presented, no further variables were found to be statistically significant. The following is a list of the variables as presented in the regression together with their definitions for ease of reference. Amplification of these can be found in the first part of this chapter, Description of Data.

| Variable | Definition | Abbreviation |
|---|---|---|
| C1 | Final Contract Period | FCP |
| C2 | Type of Work | TOW |
| C3 - C7 | Client Body | CLIENT |
| C8 - C15 | Form of Contract | FOC |
| C16 | Type of Contract | TOC |
| C17 - C28 | Location | LOCTN |
| C29 | Date Work Started | DWS |
| C30 | Adjusted Original Contract Value | AOCV |
| C31 | Adjusted Additional Contract Value | AACV |
| C32 - C35 | Causes of Delay | A B C D |

Using the SPSS programme, a stepwise regression analysis was performed on the data within each defined category. In all cases the dependent variable C1 was the final contract period (FCP) as it is intended to indicate which variables are statistically significant in predicting time. The output from the regression indicates the combined effects of a set of independent variables C2 - C35.

## Interpreting the regression output

Multiple linear regression extends bivariate regression by incorporating multiple independent variables. The model assumes that there is a normal distribution of the dependent variable (C1) for every combination of the values of the independent variables (C2 to C35) in the model. For example, with time (FCP) as the dependent variable and adjusted original contract value (AOCV) and date work started (DWS) as the independent variables, it is assumed that for every combination of AOCV and DWS there is a normal distribution of FCP and that, though the means of these distributions may differ, they all have the same variance.

One of the first steps in developing an equation with several independent variables, is to calculate a correlation matrix of all variables. The following is an extract from the matrix produced for File 1, Residential. The full matrix can be seen in Appendix A with the SPSS output.

|  | C29<br>(DWS) | C30<br>(AOCV) |
|---|---|---|
| C1 | -0.04666 | 0.72965 |
| C24 | -0.03415 | -0.08067 |
| C25 | -0.04464 | -0.03997 |
| C26 | 0.23583 | -0.08672 |
| C27 | -0.24268 | -0.06709 |
| C28 | 0.01359 | 0.00318 |
| C29 | 1.00000 | -0.10451 |
| C30 | -0.10451 | 1.00000 |
| C31 | -0.05123 | 0.57813 |

The matrix shows the correlations between the dependent variable and the indepent variables and also the correlations between the indepent variables themselves. The correlation coefficients indicate the strength of the linear relationship. The largest value possible is +1 or -1 which occurs when the points fall exactly on a line. A value of 0 indicates no linear relationship.

For multiple regression it is possible to assign relative importance to each independent variable. For example, it may be desirable to know whether AOCV is more influential than DWS in predicting FCP. There are two possible answers depending upon which one of the following questions is asked.

1. How important are AOCV and DWS when each of them alone is used to predict FCP?

2. How important are AOCV and DWS when, along with other independent variables in the regression equation, they are used to predict FCP?

The first question is answered by looking at the correlation coefficients between FCP and the independent variable. The larger the coefficient is in absolute value, the stronger the linear association. From the matrix above, AOCV correlates more highly with FCP than does DWS (0.72965 and -0.04666 respectively). Thus you would assign more importance to AOCV than to DWS as a predictor to FCP.

The answer to the second question is more complicated. When individual independent variables are correlated among themselves, the unique contribution is difficult to assess. Any statement about an independent variable is contingent upon the other variables in the equation. For example, the regression coefficient B for AOCV is 0.000033 when it is the sole independent variable in the equation, compared with 0.000044 when the other independent variables enter the equation.

For each analysis performed a variety of statistical data are produced. The following is a guide to interpreting the output.

**Multiple r:** the correlation between the dependent variable and the entire set of independent variables. The nearer the value to +1 or -1 the stronger is the linear relationship The multiple r is the multivariate counterpart to the simple correlation r.

r square: the proportion of variance in the dependent variable associated with the independent variables. This proportion is a good indicator of the explanatory power of the regression model. The closer r squared is to +1, the stronger the assumed positive relationship of an r squared of 0.9946 indicates that about 99% of the variation in the estimate is explained by the variables in the model.

B: the regression coefficient which measures the rate of change in the dependent variable C1 per unit change in the independent variable C2 to C35.

SE B: the standard error of the regression coefficient B.

F-Value: the value of the F-test.

Residential

| | |
|---|---|
| Number of cases | 81 |
| Regression | Variables C1 to C35 |
| | Regression = C1 with C2 to C35 |

The regression ceased to produce any new significant variables after step 6. The variables identified are as follows:

Multiple r = 0.84939

r square = 0.72146

Sig. F-value = 4.08

| Variable | B | SE.B | F-Value |
|---|---|---|---|
| C30 | 0.4142304E-04 | 0.00000 | 112.785 |
| C19 | -65.16674 | 17.95783 | 13.169 |
| C16 | 25.28013 | 7.42620 | 11.588 |
| C25 | 21.36383 | 6.60377 | 10.466 |
| C33 | 12.43794 | 4.74802 | 6.862 |
| C28 | -14.21492 | 6.76968 | 4.409 |
| Constant | 31.11160 | | |

| | |
|---|---|
| C30 | AOCV |
| C19 | LOCTN (East Anglia) |
| C16 | TOC |
| C25 | LOCTN (West Midlands) |
| C33 | DELAY (Bankcruptcy) |
| C28 | LOCTN (Scotland) |

Commerical

Number of cases 54

Regression Variables Cl to C35

Regression = Cl with C2 to C35

The regression ceased to produce any new significant variables after step 4. The variables identified are as follows:

Multiple r = 0.91984

r squared = 0.84610

Sig F-Value = 4.08

| Variable | B | SE.B | F-Value |
|---|---|---|---|
| C31 | 0.2177883E-04 | 0.00000 | 50.117 |
| C30 | 0.9080989E-05 | 0.00000 | 36.458 |
| C33 | 19.88923 | 5.66136 | 12.342 |
| C28 | -17.94202 | 8.14052 | 4.858 |
| | Constant 41.47678 | | |

| | |
|---|---|
| C31 | AACV |
| C30 | AOCV |
| C33 | DELAY (Bankruptcy) |
| C28 | LOCTN (Scotland) |

Remainder

Number of cases 77

Regression Variables C1 to C35

Regreession = C1 with C2 to C35

The regression ceased to produce any new significant variables after step 9.

The variables identified are as follows:

Multiple r = 0.85678

r square = 0.73408

Sig F-Value = 4.08

| Variable | B | SE.B | F-Value |
|---|---|---|---|
| C30 | 0.1568047E-04 | 0.00000 | 95.915 |
| C33 | 26.421204 | 6.27862 | 17.708 |
| C14 | 73.03123 | 13.76409 | 28.153 |
| C4 | 33.04466 | 9.05469 | 13.319 |
| C16 | 13.14206 | 6.17692 | 4.527 |
| C29 | 13.53457 | 5.65839 | 5.713 |
| C18 | 23.80272 | 11.47206 | 4.305 |
| C26 | 13.29007 | 6.08866 | 4.764 |
| C9 | 18.47974 | 9.00584 | 4.211 |

Constant -19.52984

| | |
|---|---|
| C30 | AOCV |
| C33 | DELAY (Bankruptcy) |
| C14 | FOC (GC/Wks/1) |
| C4 | CLIENT (Local Authority) |
| C16 | TOC |
| C29 | DWS |
| C18 | LOCTN (East Midlands) |
| C26 | LOCTN (North West) |
| C9 | FOC (JCT 63 Private Edition with Quantities) |

All combined

Number of cases 212

Regression Variables Cl to C35

Regression = Cl with C2 to C35

The regression ceased to produce any new significant variables after step 9. The variables identified are as follows:

Multiple r = 0.79287

r square = 0.62865

Sig F-Value = 3.84

| Variable | B | SE.B | F-Value |
|---|---|---|---|
| C30 | 0.1350130E-04 | 0.00000 | 100.065 |
| C33 | 19.79271 | 3.93187 | 25.340 |
| C16 | 17.69783 | 4.53627 | 15.221 |
| C4 | 32.88517 | 6.90145 | 22.705 |
| C6 | 24.03747 | 5.54860 | 18.768 |
| C31 | 0.1016660E-04 | 0.00000 | 15.037 |
| C14 | 50.83213 | 12.42133 | 16.747 |
| C35 | 17.68011 | 8.29145 | 4.547 |
| C9 | 13.90079 | 6.89980 | 4.059 |
| Constant | 10.17404 | | |

| | |
|---|---|
| C30 | AOCV |
| C33 | DELAY (Bankruptcy) |
| C16 | TOC |
| C4 | CLIENT (Local Authority) |
| C6 | CLIENT (Housing Association) |
| C31 | AACV |
| C14 | FOC (GC/ Wks/1) |
| C35 | DELAY (Labour/materials shortage) |
| C9 | FOC (JCT 63 LA Edition with Quantities) |

The multiple regression equations obtained from the previous three analyses suggest several findings.

| | AOCV | LOCTN | DWS | AACV | FOC | CLIENT | DELAY | TOC |
|---|---|---|---|---|---|---|---|---|
| Residential | X | X | | | | | X | X |
| Commerical | X | X | | X | | | X | |
| Remainder | X | X | X | | X | X | X | X |

There is an apparent commonality in the selection of the significant variables by the regression analysis. In every case it appears that AOCV, LOCTN and DEL ,AY are significant. It was therefore decided to look at the output from the All Combined file. The findings are as follows:

| | AOCV | LOCTN | DWS | AACV | FOC | CLIENT | DELAY | TOC |
|---|---|---|---|---|---|---|---|---|
| Residential | X | X | | | | | X | X |
| Commercial | X | X | | X | | | X | |
| Remainder | X | X | X | | X | X | X | X |
| All | X | | X | X | X | X | X | X |

The selection of the variables to predict time has, to some extent, been arbitrary. It is unlikely that all relevant variables have been identified and measured. Doubtless some good variables have been excluded, while some of those included may not be very good predictors. This is not unusual; it is necessary to build the model from the available data as voluminous or scant as they may be.

As there was a degree of commonality of results it was decided to use the All Combined file to calculate the regression equation for predicting time. This file contains the largest amount of data available and was therefore considered to be most reliable. From the output it appears that AOCV and DELAY are the most influential predictors of time with LOCTN and TOC being the next best predictors.

From the All Combined output we can use the following regression equation for the purposes of predicting time:

$$\begin{aligned}
\text{Time (in weeks)} \quad = \quad & 10.17 + [0.0000135013\ C30] \\
& + [19.79\ C33] + [17.70\ C16] \\
& + [32.89\ C4] + [24.04\ C6] \\
& + [0.00001017\ C31] + [50.83\ C14] \\
& + [17.68\ C35] = [13.90\ C9]
\end{aligned}$$

C30 = AOCV [Value adjusted for location to 4thQ 1977]

C33 = DELAY [Bankruptcy]

C16 = TOC [Fluctuating costs]

C4 = CLIENT [Local Authority]

C6 = CLIENT [Housing Association]

C31 = AACV [Value adjusted for location to 4thQ 1977]

C14 = FOC [GC/Wks/1]

C35 = DELAY [Labour/Materials shortage]

C9 = FOC [JCT Local Authority Ed with quantities]

This means that applying the criteria listed above in terms of the variables, it is possible to predict the time required for a project in weeks from start on site to practical completion.

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# CHAPTER SIX

# CONCLUSION

# CHAPTER SIX

## CONCLUSION

The time taken for construction is a much maligned element of the total project. It has been seen through this research and other relevant studies that the predicted time is frequently exceeded. To date, the industry has had no scientific method of making that time prediction, moreover it is often left to the judgement of a professional quantity surveyor. This contrasts with the often very sophisticated models for controlling time when the project is actually under construction. Clearly to accurately control an inaccurately predicted time value makes nonsense of the control system. In order to provide better and more effective time and cost control it is imperative that a more accurate system for predicting time is devised. This research set out to identify those factors affecting the time/cost relationship and attempts to prepare a model whereby the time for construction can be accurately predicted.

The results are promising: this research has indicated that a number of factors are significant in predicting time and demonstrates that it is possible to quantify the effects thus producing a more accurate assessment of the time element. From the output detailed in Chapter Five, the regression performed on all the data (File 4 : All Combined), identified nine significant variables. These are:

AOCV : Adjusted original contract value
DELAY : Bankruptcy
TOC : Fixed or fluctuating contract
CLIENT : Local Authority
CLIENT : Housing Association
AACV : Adjusted additional contract value
FOC : GC/Wks/1 form
DELAY : Labour/materials shortage
FOC : JCT 63 LA Edition with quantities form

These factors then are all proven to have a significant effect on time and should be allowed for in any predictive calculation. The following is an interpretation of the possible reasons why those variables should be significant.

AOCV

The cost of the project, as submitted by the successful tenderer, should clearly represent the size, complexity, quality and function of the building. It has been demonstrated through the regression analysis that the original contract value is significant in the prediction of the contract period. The accuracy of this prediction must therefore be dependent upon the accuracy of the prediction of the contract value during the design stage.

A single unit price rate method of estimating contract value is by definition limited in that it is attempting to be the panacea for all eventualities. As the design develops, so too should the estimate as the method of calculation becomes more comprehensive. It follows therefore that an accurate estimation of contract value should lead to an accurate prediction of the contract period.

Where the cost is identified as signficant in the prediction of time, it follows that the surveyor should be more diligent in the prediction of cost. A poor estimation of cost in the early stages of design may have been the basis of the prediction of time resulting in an underestimation of the contract period, the reality being a higher contract value which may manifest itself in an overrun on the contract period.

Bennett (1982) found that the mean deviation of estimates of cost from tenders ranged from 5.5% to 18% depending upon which method of estimation is adopted. With this apparent deviation, it follows from this research that similar deviation in time may also occur. It has been found through this research that the mean overrun on contract period was 14% which equates with Bennett's research on estimates and tenders.

On the basis of the findings of this research it can be stated that if the profession were more diligent in their assessment of estimated contract value, the estimated time could be made more accurate since cost is a component of the prediction equation.

As we have seen in the previous chapter this component contributes 0.0000135 weeks of the contract period per £1 change in cost.

## DELAY : Bankruptcy

A bankruptcy during the duration of the contract will, not surprisingly, cause serious delay to the progress of the works. This is not a factor which can be anticipated at the outset not should it be allowed for in the prediction of time. It is the responsibility of the Architect to select a contractor, through whichever means he feels appropriate, who is unlikely to go bankrupt. This is not always possible to do as it is impossible for the Architect to be informed of the internal machinations of the organisation. The best that can be expected is for the risk of bankruptcy to be minimised.

Its identification in this model merely shows the average quantifiable effect a bankruptcy will have should it occur, based on the sample used in this analysis. It is shown that an addition of 19.79 weeks is taken to complete a project when bankruptcy occurs. The figure merely serves as a guide to the building team in the event of bankruptcy.

### TOC : Fixed or fluctuating cost contracts

The basis upon which contract costs are reimbursed is clearly important to both the client and the contractor. At tendering stage, the tenderers will be informed through the contract documentation of whether the costs will be fixed for the duration of the contract period (fixed costs) or whether they will be increased in line with inflation (fluctuating costs).

Normally fixed cost contracts are restricted to contract periods of 12 months and under so as to minimise the risk of loss on recovery of costs to the contractor.

This information is important to the tenderer for, if a fixed cost basis is stipulated, then he needs to make allowances in his prices for any likely increases in costs over the period of the contract. A fluctuating cost contract removes that element of risk for the contractor but leaves the client with an undefined contract value at the start of the contract upon which he may have to arrange finance.

The basis of recovery of costs then may provide for the client an incentive or disincentive to complete the project on time. A fixed cost contract may mean the contractor absorbing costs not allowed for in the tender price should the contract go beyond the stated contract period. As a result, the regression equation makes no addition to contract time for fixed price contracts.

Fluctuating contracts on the other hand, may provide a source of extra income generation. As time progresses and moves further from the base date for prices, the effects of inflation become greater. As a consequence, there could almost be a disincentive to complete on time. A contractually allowable extension of time will not attract any penalties through the contract but may increase the profit made through increased costs. As a result, the regression equation makes an addition of 17.7 weeks to the contract period for fluctuating contracts.

CLIENT : Local Authority or Housing Association

The Wood Report (1975) found that the pressures placed upon the building team by the client have some bearing on the success of the project in terms of contract duration. Clearly then the client body can go some way to ensuring that contracts are completed on time.

This research has identified two particular client bodies whose existence apparently increases the time required for completion of a project. The individual effect of each on the contract period is different:

Local Authority : + 32.89 weeks
Housing Association : + 24.04 weeks

These two bodies fall within the category of quasi-commerical clients whose overall objective in development terms is one of social commitment and therefore essentially a non-profit making organisation. As a quasi-commercial client, the organisation will yield a return during the course of the development through such activities as rent collection though this return is not expected to be a profit for the organisation and as such all revenue will be returned into the organisation. This social attitude may be the catalyst insofar as adhering rigidly to completion dates - the prime objective is to provide a satisfactory scheme and not to produce a profit.

Both Local Authorities and Housing Associations adopt a non-corporate management strategy. The Bains Report (1972) concluded by believing that local government should adopt a corporate approach in order to ensure that their resources are deployed most effectively and that they become both efficient and effective in their operation. Similarly, Housing Assocaitions are non-profit making often charitable organisations set up on a non-corporate structure to serve the needs of the community at large in terms of the provision of housing.

Clearly this non-corporate structure goes a long way to determining the efficiency of the client organisation and hence its appearance in the regression. The existence of either a Local Authority or a Housing Association client will result in an increased contract period, in relation to any other type of client.

### AACV : Additional Adjusted Contract Value

As with the original adjusted contract value, the cost of the project is a large determining factor in the time allowance for the construction of the project. It is often the case, that after the original contract limit has been set and agreed by the client, additional reequirements are made by the client which inevitably involve some cost implication. This may occur either before or after the contract has been signed. If it is before the signing of the contract then there is little problem in that the predicted contract period can simply be altered to take account of these additional requirements.

The regression model here indicates that the following addition to the contract period should be made based on the additional contract value:

Additional Period = 0.0000102 weeks

The problem occurs, as is often the case, when this event takes place after the signing of the contract and during the progress of the works. To some extent the effect is detrimental as this would undoubtedly affect the preset construction programme and to alter it would probably increase the additional time allowance. The allowance indicated above is not intended to apply in this situation though it could be used by the building team as a guide to the likely additional effect.

FOC : GC/WKS/1 Form and JCT 63 LA Edition with quantities

There are a variety of standard forms of contract in use in the construction industry. The choice of a particular form will depend upon the circumstances surrounding the project. The forms are often more suited to either building or civil engineering, although forms are available that are appropriate to both these sectors of the construction industry. The status of the designer will also affect this choice. Local Authorities and particularly central government departments have devised their own forms of contract. Although the central government form is considerably different, local authorities will often use a version of a form that is also used in the private sector. Another factor affecting the choice of form is the size of the project, since the erection of small works need not embrace the complete conditions necessary on major contracts.

This choice of form of contract has undoubtedly left the industry with something of a dilemma in ensuring that the correct form of contract is chosen for the conditions applying. The Banwell Report (1964) recommended that a single form of contract for the whole of the construction industry was both desirable and practicable. This suggestion has never been acted upon, indeed since the report was made many more forms have been introduced which led to clouding the issue further. Central government departments will most likely continue to use the GC/Wks/1 form as will local authorities contunue to use JCT 63 Local Authority Editions (or their most recent updated edition, currently JCT80).

There is some link here with the forms of contract identified by the regression as being significant to the prediction of time and the client bodies which also affect the time prediction. The forms identified here are both used by quasi-commerical clients and have links with the non-corporate status that they enjoy.

Unlike many other standard forms of contract in use in the UK, these two forms are seldom used by bodies other than local or central government departments.

Clearly the choice of form of contract is important to the issue of satisfactory completion of contracts within the stipulated contract period. Whilst it is not the objective of this research to indicate where and when to use a particular form of contract it is important to know the effect that a particular form of contract may have on the contract period. In this respect two forms of contract were identified by the regression as having a time implication. The effects are as follows:

GC/Wks/1 form : + 50.83 weeks
JCT 63 LA ed : + 13.90 weeks

Having identified the significant factors affecting the prediction of time and attempted to explain their appearance, from the regression performed and detailed in Chapter Five, the following factors should be taken into account in the prediction equation:

---

FOOTNOTE

The variables identified on this page and on page 103 require further explanation.
CLIENT : The Housing Association being more specialised should therefore be more efficient thereby attracting a lower time implication.
FOC : GC/Wks/1 contracts tend to be of much greater value and as a result a larger time implication would be expected.
The coefficients represent the number of weeks taking account of the effects of the other variables in the equation.

$$\begin{aligned} \text{Time} = {} & 10.17 + 0.0000135\ C30 + 19.79\ C33 + 17.70\ C16 + 32.89\ C4 \\ & + 24.04\ C6 + 0.0000102\ C31 + 50.83\ C14 + 17.68\ C35 \\ & + 13.90\ C9 \end{aligned}$$

where C30 = AOCV (estimated original cost)
C33 = DELAY (Bankruptcy)
C16 = TOC (0 if fixed contract, 1 if fluctuating costs)
C4 = CLIENT (Local Authority)
C6 = CLIENT (Housing Association)
C31 = AACV (estimated additional cost)
C14 = FOC (GC/Wks/1)
C35 = DELAY (labour/materials shortage)
C9 = FOC (JCT 63 LA Ed with quantities)

Since the delay factors Bankruptcy and Labour/Materials shortage cannot be foreseen at the time of prediction, they can be dropped out of the prediction equation or equivalently C33 and C35 each assumes the value 0.

## APPLICATION OF THE EQUATION TO A RANDOM SAMPLE OF QUESTIONNAIRES

| | CALCULATED (WEEKS) | ORIGINAL (WEEKS) | ACTUAL (WEEKS) |
|---|---|---|---|
| HOUSING | | | |
| H4 | 68 | 36 | 82 |
| H17 | 125 | 108 | 152 |
| H37 | 57 | 40 | 42 |
| H56 | 80 | 91 | 104 |
| H69 | 71 | 65 | 100 |
| H79 | 82 | 72 | 80 |
| INDUSTRIAL | | | |
| I1 | 94 | 144 | 87 |
| I15 | 44 | 36 | 29 |
| I21 | 81 | 39 | 51 |
| COMMERCIAL | | | |
| C21 | 114 | 69 | 82 |
| C29 | 248 | 156 | 289 |
| C36 | 78 | 96 | 120 |
| C44 | 48 | 50 | 54 |
| EDUCATIONAL | | | |
| E2 | 80 | 56 | 87 |
| E7 | 77 | 56 | 53 |
| MEDICAL | | | |
| M3 | 77 | 66 | 83 |
| RECREATIONAL | | | |
| R2 | 100 | 96 | 110 |
| TRANSPORT | | | |
| T1 | 46 | 20 | 41 |
| SUNDRY | | | |
| S4 | 87 | 70 | 72 |
| S10 | 82 | 74 | 92 |

What appears to be clear from the testing of the equation is that where an unrealsitic time is stated in the contract documents, this leads to a time well beyond that calculated using the equation. This is in line with the findings of Bromilow (refer Chapter three).

This research has attempted to look at the problems of predicting the time required for constructon of building projects. The investigations have centred on the factors affecting time and the effects these have had on actual construction periods. The statistical analysis made resulted in a simplistic model for predicting the construction period.

The results from the application of the equation to a random sample of questionnaires on page 109 show the model to be adequate for predicting time. The following are two possible areas for taking the research further, these being:-

(1) The data collected has all been brought to a common cost base of 4th quarter 1977 for analysis purposes. The results therefore relate to the state of the industry and the economy as it was at that time. It would be interesting to determine whether the model would change for different calendar dates with the ultimate aim of producing a generic model that could be used, regardless of date.

(2) The model could be further refined with some investigation of how the significant variables inter-relate and whether these variables change with the date.

It is hoped that this initial piece of work is taken further as it is believed that it is possible to make a more accurate assessment of the time taken than it appears currently to be possible to do.

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# APPENDIX A

## SPSS STATISTICAL DATA OUTPUT EXTRACTS

```
SPSS FOR ND-500, VERSION M, RELEASE 8.0A, OCTOBER 15, 1979
DEFAULT SPACE ALLOCATION..     ALLOWS FOR..    81 TRANSFORMATIONS
WORKSPACE      57344 BYTES                    327 RECODE VALUES + LAG VARIABLES
TRANSPACE       8192 BYTES                   1314 IF/COMPUTE OPERATIONS
LABELSPACE     32768 BYTES                  32768 BYTES MEMORY RESIDENT FILE SPACE

                  1 RUN NAME             RESIDENTIAL2
                  2 FILE NAME            STUDY5
                  3 VARIABLE LIST        C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,
                  4                      C15,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,
                  5                      C27,C28,C29,C30,C31,C32,C33,C34,C35,
                  6 INPUT MEDIUM         DISK
                  7 N OF CASES           81
                  8 INPUT FORMAT         FREEFIELD
                  9 REGRESSION           VARIABLES = C1 TO C35
                 10                      REGRESSION = C1 WITH C2 TO C35 RESID=0/
                 11 STATISTICS           ALL

 ***** REGRESSION PROBLEM REQUIRES  21840 BYTES WORKSPACE, NOT INCLUDING RESIDUALS *****


                 12 READ INPUT DATA
```

```
FILE    STUDY5    (CREATION DATE = 04/25/88)

VARIABLE               MEAN        STANDARD DEV      CASES

C1                  79.3457             32.6394         81
C2                    .1975               .4006         81
C3                    .0000               .0000         81
C4                    .5802               .4966         81
C5                    .0000               .0000         81
C6                    .3086               .4648         81
C7                    .0000               .0000         81
C8                    .0494               .2180         81
C9                    .4198               .4966         81
C10                   .0000               .0000         81
C11                   .0000               .0000         81
C12                   .0000               .0000         81
C13                   .0000               .0000         81
C14                   .0000               .0000         81
C15                   .0000               .0000         81
C16                   .9136               .2827         81
C17                   .0247               .1561         81
C18                   .0617               .2422         81
C19                   .0247               .1561         81
C20                   .0247               .1561         81
C21                   .1852               .3909         81
C22                   .1111               .3162         81
C23                   .0741               .2635         81
C24                   .0247               .1561         81
C25                   .1111               .3162         81
C26                   .1728               .3805         81
C27                   .0370               .1900         81
C28                   .0988               .3002         81
C29                  1.6049               .4919         81
C30             544461.2099         721411.8654         81
C31              33115.0247          91963.4741         81
C32                   .2840               .4537         81
C33                   .2593               .4410         81
C34                   .1481               .3575         81
C35                   .0741               .2635         81
```

```
CORRELATION COEFFICIENTS

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.



              C1        C2        C3        C4        C5        C6        C7        C8        C9       C10       C11       C12

C1       1.00000   -.13052  99.00000    .05611  99.00000   -.01948  99.00000    .09419   -.05611  99.00000  99.00000  99.00000
C2       -.13052   1.00000  99.00000    .10782  99.00000   -.13011  99.00000    .45939   -.10782  99.00000  99.00000  99.00000
C3      99.00000  99.00000   1.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C4        .05611    .10782  99.00000   1.00000  99.00000   -.78557  99.00000    .19385  -1.00000  99.00000  99.00000  99.00000
C5      99.00000  99.00000  99.00000  99.00000   1.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C6       -.01948   -.13011  99.00000   -.78557  99.00000   1.00000  99.00000   -.15229    .78557  99.00000  99.00000  99.00000
C7      99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C8        .09419    .45939  99.00000    .19385  99.00000   -.15229  99.00000   1.00000   -.19385  99.00000  99.00000  99.00000
C9       -.05611   -.10782  99.00000  -1.00000  99.00000    .78557  99.00000   -.19385   1.00000  99.00000  99.00000  99.00000
C10     99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000  99.00000  99.00000
C11     99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000  99.00000
C12     99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000
C13     99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C14     99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C15     99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C16       .33920    .15259  99.00000    .00550  99.00000    .01527  99.00000    .07010   -.00550  99.00000  99.00000  99.00000
C17       .01302    .12088  99.00000   -.18707  99.00000    .23814  99.00000   -.03626    .18707  99.00000  99.00000  99.00000
C18       .01150   -.12726  99.00000    .01027  99.00000   -.06032  99.00000   -.05846   -.01027  99.00000  99.00000  99.00000
C19       .30733   -.07894  99.00000    .13533  99.00000   -.10631  99.00000   -.03626   -.13533  99.00000  99.00000  99.00000
C20      -.04339   -.07894  99.00000    .13533  99.00000   -.10631  99.00000   -.03626   -.13533  99.00000  99.00000  99.00000
C21       .21244    .40209  99.00000    .08348  99.00000    .02548  99.00000    .47809   -.08348  99.00000  99.00000  99.00000
C22      -.24114    .02193  99.00000   -.01769  99.00000   -.15119  99.00000   -.08058    .01769  99.00000  99.00000  99.00000
C23      -.08585   -.02193  99.00000   -.04599  99.00000    .11717  99.00000   -.06447    .04599  99.00000  99.00000  99.00000
C24      -.15621   -.07894  99.00000   -.18707  99.00000    .23814  99.00000   -.03626    .18707  99.00000  99.00000  99.00000
C25       .13066   -.17541  99.00000   -.01769  99.00000   -.06614  99.00000   -.08058    .01769  99.00000  99.00000  99.00000
C26       .06559   -.14478  99.00000   -.07433  99.00000    .04800  99.00000   -.10419    .07433  99.00000  99.00000  99.00000
C27      -.07867   -.09730  99.00000    .03434  99.00000    .01048  99.00000   -.04470   -.03434  99.00000  99.00000  99.00000
C28      -.11451    .04363  99.00000    .19771  99.00000   -.22119  99.00000   -.07545   -.19771  99.00000  99.00000  99.00000
C29      -.04666    .14722  99.00000    .02906  99.00000   -.06142  99.00000    .06763   -.02906  99.00000  99.00000  99.00000
C30       .72965   -.08612  99.00000    .04549  99.00000   -.03611  99.00000   -.02405   -.04549  99.00000  99.00000  99.00000
C31       .59052    .13905  99.00000    .05247  99.00000   -.08276  99.00000    .26714   -.05247  99.00000  99.00000  99.00000
C32       .00679    .03141  99.00000    .20273  99.00000   -.12440  99.00000    .10921   -.20273  99.00000  99.00000  99.00000
C33       .19606   -.15200  99.00000   -.01057  99.00000    .03162  99.00000   -.00482    .01057  99.00000  99.00000  99.00000
C34      -.07623    .05496  99.00000    .00261  99.00000   -.12817  99.00000   -.09505   -.00261  99.00000  99.00000  99.00000
C35       .21498    .09648  99.00000    .04953  99.00000    .01512  99.00000    .15311   -.04953  99.00000  99.00000  99.00000
```

```
FILE    STUDY5    (CREATION DATE = 04/25/88)



               C13        C14        C15        C16        C17        C18        C19        C20        C21        C22        C23        C24

C1         99.00000   99.00000   99.00000     .33920     .01302     .01150     .30733    -.04339     .21244    -.24114    -.08585    -.15621
C2         99.00000   99.00000   99.00000     .15259     .12088    -.12726    -.07894    -.07894     .40209     .02193    -.02193    -.07894
C3         99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C4         99.00000   99.00000   99.00000     .00550    -.18707     .01027     .13533     .13533     .08348    -.01769    -.04599    -.18707
C5         99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C6         99.00000   99.00000   99.00000     .01527     .23814    -.06032    -.10631    -.10631     .02548    -.15119     .11717     .23814
C7         99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C8         99.00000   99.00000   99.00000     .07010    -.03626    -.05846    -.03626    -.03626     .47809    -.08058    -.06447    -.03626
C9         99.00000   99.00000   99.00000    -.00550     .18707    -.01027    -.13533    -.13533    -.08348     .01769     .04599     .18707
C10        99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C11        99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C12        99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C13         1.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C14        99.00000    1.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C15        99.00000   99.00000    1.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C16        99.00000   99.00000   99.00000    1.00000     .04894     .07889     .04894     .04894     .14662    -.31068     .08699    -.23420
C17        99.00000   99.00000   99.00000     .04894    1.00000    -.04081    -.02532    -.02532    -.07585    -.05625    -.04500    -.02532
C18        99.00000   99.00000   99.00000     .07889    -.04081    1.00000    -.04081    -.04081    -.12228    -.09068    -.07255    -.04081
C19        99.00000   99.00000   99.00000     .04894    -.02532    -.04081    1.00000    -.02532    -.07585    -.05625    -.04500    -.02532
C20        99.00000   99.00000   99.00000     .04894    -.02532    -.04081    -.02532    1.00000    -.07585    -.05625    -.04500    -.02532
C21        99.00000   99.00000   99.00000     .14662    -.07585    -.12228    -.07585    -.07585    1.00000    -.16855    -.13484    -.07585
C22        99.00000   99.00000   99.00000    -.31068    -.05625    -.09068    -.05625    -.05625    -.16855    1.00000    -.10000    -.05625
C23        99.00000   99.00000   99.00000     .08699    -.04500    -.07255    -.04500    -.04500    -.13484    -.10000    1.00000    -.04500
C24        99.00000   99.00000   99.00000    -.23420    -.02532    -.04081    -.02532    -.02532    -.07585    -.05625    -.04500    1.00000
C25        99.00000   99.00000   99.00000    -.17088    -.05625    -.09068    -.05625    -.05625    -.16855    -.12500    -.10000    -.05625
C26        99.00000   99.00000   99.00000     .14059    -.07273    -.11725    -.07273    -.07273    -.21792    -.16161    -.12929    -.07273
C27        99.00000   99.00000   99.00000    -.17234    -.03120    -.05030    -.03120    -.03120    -.09349    -.06934    -.05547    -.03120
C28        99.00000   99.00000   99.00000     .10182    -.05267    -.08491    -.05267    -.05267    -.15782    -.11704    -.09363    -.05267
C29        99.00000   99.00000   99.00000    -.06879     .12858    -.10753    -.03415    -.03415    -.00482    -.03571    -.06071    -.03415
C30        99.00000   99.00000   99.00000     .16775     .07837    -.05552     .68697    -.03752     .16389    -.17286    -.08658    -.08067
C31        99.00000   99.00000   99.00000     .10940    -.01204    -.08069     .01235    -.05765     .41119    -.08619    -.10086    -.05691
C32        99.00000   99.00000   99.00000     .09624     .07624    -.04775     .07624    -.10020    -.01827    -.04840     .13552     .07624
C33        99.00000   99.00000   99.00000     .18196    -.09413     .08238    -.09413     .08741     .00806     .05976    -.16733    -.09413
C34        99.00000   99.00000   99.00000    -.11910    -.06635     .03744    -.06635     .15759     .06958     .07372    -.11795    -.06635
C35        99.00000   99.00000   99.00000     .08699     .25877    -.07255     .25877    -.04500    -.01348    -.10000     .10000    -.04500
```

| | C25 | C26 | C27 | C28 | C29 | C30 | C31 | C32 | C33 | C34 | C35 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | .13066 | .06559 | -.07867 | -.11451 | -.04666 | .72965 | .59052 | .00679 | .19606 | -.07623 | .21498 |
| C2 | -.17541 | -.14478 | -.09730 | .04363 | .14722 | -.08612 | .13905 | .03141 | -.15200 | .05496 | .09648 |
| C3 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C4 | -.01769 | -.07433 | .03434 | .19771 | .02906 | .04549 | .05247 | .20273 | -.01057 | .00261 | .04953 |
| C5 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C6 | -.06614 | .04800 | .01048 | -.22119 | -.06142 | -.03611 | -.08276 | -.12440 | .03162 | -.12817 | .01512 |
| C7 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C8 | -.08058 | -.10419 | -.04470 | -.07545 | .06763 | -.02405 | .26714 | .10921 | -.00482 | -.09505 | .15311 |
| C9 | .01769 | .07433 | -.03434 | -.19771 | -.02906 | -.04549 | -.05247 | -.20273 | .01057 | -.00261 | -.04953 |
| C10 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C11 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C12 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C13 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C14 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C15 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C16 | -.17088 | .14059 | -.17234 | .10182 | -.06879 | .16775 | .10940 | .09624 | .18196 | -.11910 | .08699 |
| C17 | -.05625 | -.07273 | -.03120 | -.05267 | .12858 | .07837 | -.01204 | .07624 | -.09413 | -.06635 | .25877 |
| C18 | -.09068 | -.11725 | -.05030 | -.08491 | -.10753 | -.05552 | -.08069 | -.04775 | .08238 | .03744 | -.07255 |
| C19 | -.05625 | -.07273 | -.03120 | -.05267 | -.03415 | .68697 | .01235 | .07624 | -.09413 | -.06635 | .25877 |
| C20 | -.05625 | -.07273 | -.03120 | -.05267 | -.03415 | -.03752 | -.05765 | -.10020 | .08741 | .15759 | -.04500 |
| C21 | -.16855 | -.21792 | -.09349 | -.15782 | -.00482 | .16389 | .41119 | -.01827 | .00806 | .06958 | -.01348 |
| C22 | -.12500 | -.16161 | -.06934 | -.11704 | -.03571 | -.17286 | -.08619 | -.04840 | .05976 | .07372 | -.10000 |
| C23 | -.10000 | -.12929 | -.05547 | -.09363 | -.06071 | -.08658 | -.10086 | .13552 | -.16733 | -.11795 | .10000 |
| C24 | -.05625 | -.07273 | -.03120 | -.05267 | -.03415 | -.08067 | -.05691 | .07624 | -.09413 | -.06635 | -.04500 |
| C25 | 1.00000 | -.16161 | -.06934 | -.11704 | .04464 | -.03997 | -.09837 | -.04840 | -.20917 | .07372 | .20000 |
| C26 | -.16161 | 1.00000 | -.08965 | -.15132 | .23583 | -.08672 | -.01927 | -.07062 | .32562 | -.00681 | -.12929 |
| C27 | -.06934 | -.08965 | 1.00000 | -.06492 | -.24268 | -.06709 | -.07106 | -.12350 | .03315 | -.08179 | -.05547 |
| C28 | -.11704 | -.15132 | -.06492 | 1.00000 | .01359 | .00318 | -.01797 | -.02493 | -.00699 | -.02157 | -.09363 |
| C29 | .04464 | .23583 | -.24268 | .01359 | 1.00000 | -.10451 | -.05123 | -.05117 | -.04055 | .19483 | .03571 |
| C30 | -.03997 | -.08672 | -.06709 | .00318 | -.10451 | 1.00000 | .57813 | .08745 | .00132 | -.12412 | .18306 |
| C31 | -.09837 | -.01927 | -.07106 | -.01797 | -.05123 | .57813 | 1.00000 | .08309 | .09458 | -.02101 | -.00185 |
| C32 | -.04840 | -.07062 | -.12350 | -.02493 | -.05117 | .08745 | .08309 | 1.00000 | -.37255 | -.26261 | -.17811 |
| C33 | -.20917 | .32562 | .03315 | -.00699 | -.04055 | .00132 | .09458 | -.37255 | 1.00000 | -.24672 | -.16733 |
| C34 | .07372 | -.00681 | -.08179 | -.02157 | .19483 | -.12412 | -.02101 | -.26261 | -.24672 | 1.00000 | -.11795 |
| C35 | .20000 | -.12929 | -.05547 | -.09363 | .03571 | .18306 | -.00185 | -.17811 | -.16733 | -.11795 | 1.00000 |

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FILE    STUDY5    (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  1..    C30


MULTIPLE R           .72965                     ANALYSIS OF VARIANCE    DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE             .53238                     REGRESSION               1.        45373.21275        45373.21275           89.94239
ADJUSTED R SQUARE    .52647                     RESIDUAL                79.        39853.10823          504.46972
STANDARD ERROR     22.46040


----------------- VARIABLES IN THE EQUATION ------------------            ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE           B          BETA     STD ERROR B        F               VARIABLE     BETA IN     PARTIAL    TOLERANCE            F

C30          .3301197E-04     .72965        .00000     89.942             C2           -.06818     -.09934       .99258         .777
(CONSTANT)   61.37194                                                     C3      999999.99999 99999.99999       .00000    99999.999
                                                                          C4            .02297      .03355       .99793         .088
                                                                          C5      999999.99999 99999.99999       .00000    99999.999
                                                                          C6            .00688      .01005       .99870         .008
                                                                          C7      999999.99999 99999.99999       .00000    99999.999
                                                                          C8            .11180      .16345       .99942        2.141
                                                                          C9           -.02297     -.03355       .99793         .088
                                                                          C10     999999.99999 99999.99999       .00000    99999.999
                                                                          C11     999999.99999 99999.99999       .00000    99999.999
                                                                          C12     999999.99999 99999.99999       .00000    99999.999
                                                                          C13     999999.99999 99999.99999       .00000    99999.999
                                                                          C14     999999.99999 99999.99999       .00000    99999.999
                                                                          C15     999999.99999 99999.99999       .00000    99999.999
                                                                          C16           .22309      .32161       .97186        8.998
                                                                          C17          -.04443     -.06478       .99386         .329
                                                                          C18           .05217      .07617       .99692         .455
                                                                          C19          -.36720     -.39022       .52808       14.011
                                                                          C20          -.01603     -.02343       .99859         .043
                                                                          C21           .09542      .13765       .97314        1.506
                                                                          C22          -.11855     -.17076       .97012        2.343
                                                                          C23          -.02285     -.03329       .99250         .087
                                                                          C24          -.09799     -.14283       .99349        1.624
                                                                          C25           .16008      .23391       .99840        4.515
                                                                          C26           .12984      .18916       .99248        2.895
                                                                          C27          -.02986     -.04357       .99550         .148
                                                                          C28          -.11684     -.17086       .99999        2.345
                                                                          C29           .02992      .04351       .98908         .148
                                                                          C31           .25338      .30233       .66577        7.847
                                                                          C32          -.05746     -.08370       .99235         .550
                                                                          C33           .19510      .28530      1.00000        6.911
                                                                          C34           .01456      .02113       .98459         .035
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RESIDENTIAL2
                                                                                      04/25/88        PAGE    8
FILE   STUDY5   (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
DEPENDENT VARIABLE..    C1                                                                                       REGRESSION LIST  1

VARIABLE(S) ENTERED ON STEP NUMBER  2..    C19


MULTIPLE R               .77691                    ANALYSIS OF VARIANCE    DF      SUM OF SQUARES        MEAN SQUARE          F
R SQUARE                 .60359                    REGRESSION               2.        51441.69714        25720.84857      59.38282
ADJUSTED R SQUARE        .59342                    RESIDUAL                78.        33784.62384          433.13620
STANDARD ERROR         20.81192

----------------- VARIABLES IN THE EQUATION ------------------            ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE            B           BETA      STD ERROR B        F            VARIABLE        BETA IN       PARTIAL    TOLERANCE          F

C30         .4442494E-04       .98190         .00000       100.181         C2              -.07556       -.11951       .99184         1.116
C19        -76.75477          -.36720       20.50584        14.011         C3         999999.99999   99999.99999       .00000     99999.999
(CONSTANT)  57.05320                                                       C4               .06255        .09822       .97742          .750
                                                                           C5         999999.99999   99999.99999       .00000     99999.999
                                                                           C6              -.02338       -.03688       .98612          .105
                                                                           C7         999999.99999   99999.99999       .00000     99999.999
                                                                           C8               .10463        .16607       .99868         2.184
                                                                           C9              -.06255       -.09822       .97742          .750
                                                                           C10        999999.99999   99999.99999       .00000     99999.999
                                                                           C11        999999.99999   99999.99999       .00000     99999.999
                                                                           C12        999999.99999   99999.99999       .00000     99999.999
                                                                           C13        999999.99999   99999.99999       .00000     99999.999
                                                                           C14        999999.99999   99999.99999       .00000     99999.999
                                                                           C15        999999.99999   99999.99999       .00000     99999.999
                                                                           C16              .19975        .31142       .96354         8.269
                                                                           C17             -.07457       -.11736       .98199         1.075
                                                                           C18              .05119        .08117       .99690          .511
                                                                           C20             -.01587       -.02518       .99859          .049
                                                                           C21              .02611        .03948       .90590          .120
                                                                           C22             -.09563       -.14902       .96272         1.749
                                                                           C23             -.01750       -.02769       .99211          .059
                                                                           C24             -.08701       -.13763       .99178         1.487
                                                                           C25              .14973        .23743       .99683         4.600
                                                                           C26              .12502        .19778       .99215         3.135
                                                                           C27             -.02438       -.03863       .99508          .115
                                                                           C28             -.13777       -.21819       .99429         3.849
                                                                           C29              .04401        .06942       .98640          .373
                                                                           C31              .07108        .07008       .38537          .380
                                                                           C32             -.05150       -.08147       .99186          .514
                                                                           C33              .16299        .25664       .98289         5.429
                                                                           C34              .02163        .03408       .98392          .090
                                                                           C35              .13961        .21418       .93298         3.702
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  3..    C16


MULTIPLE R               .80127                      ANALYSIS OF VARIANCE   DF      SUM OF SQUARES        MEAN SQUARE              F
R SQUARE                 .64203                      REGRESSION              3.        54718.11905        18239.37302           46.03456
ADJUSTED R SQUARE        .62809                      RESIDUAL               77.        30508.20194          396.21041
STANDARD ERROR         19.90503


-------------------- VARIABLES IN THE EQUATION --------------------            ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE               B             BETA   STD ERROR B           F            VARIABLE     BETA IN     PARTIAL   TOLERANCE            F

C30             .4212955E-04      .93117        .00000      95.129            C2           -.11187     -.18355      .96374        2.650
C19            -71.51290         -.34212      19.69681      13.182            C3      999999.99999 99999.99999      .00000    99999.999
C16             23.05914          .19975       8.01874       8.269            C4            .06032      .09967      .97729         .763
(CONSTANT)      37.10715                                                      C5      999999.99999 99999.99999      .00000    99999.999
                                                                              C6           -.02563     -.04254      .98599         .138
                                                                              C7      999999.99999 99999.99999      .00000    99999.999
                                                                              C8            .09078      .15122      .99335        1.779
                                                                              C9           -.06032     -.09967      .97729         .763
                                                                              C10     999999.99999 99999.99999      .00000    99999.999
                                                                              C11     999999.99999 99999.99999      .00000    99999.999
                                                                              C12     999999.99999 99999.99999      .00000    99999.999
                                                                              C13     999999.99999 99999.99999      .00000    99999.999
                                                                              C14     999999.99999 99999.99999      .00000    99999.999
                                                                              C15     999999.99999 99999.99999      .00000    99999.999
                                                                              C17          -.07988     -.13226      .98130        1.353
                                                                              C18           .03385      .05627      .98889         .241
                                                                              C20          -.02701     -.04504      .99542         .154
                                                                              C21           .00512      .00810      .89644         .005
                                                                              C22          -.04222     -.06638      .88490         .336
                                                                              C23          -.03874     -.06414      .98103         .314
                                                                              C24          -.04558     -.07397      .94296         .418
                                                                              C25           .18889      .31055      .96761        8.112
                                                                              C26           .09649      .15865      .96770        1.962
                                                                              C27           .00779      .01281      .96877         .012
                                                                              C28          -.15820     -.26243      .98504        5.621
                                                                              C29           .05356      .08880      .98415         .604
                                                                              C31           .08999      .09321      .38403         .666
                                                                              C32          -.06884     -.11417      .98460        1.004
                                                                              C33           .13251      .21621      .95297        3.727
                                                                              C34           .04150      .06847      .97437         .358
                                                                              C35           .12472      .20075      .92746        3.192
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RESIDENTIAL2                                                                              04/25/88        PAGE   10

FILE    STUDY5    (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *   M U L T I P L E   R E G R E S S I O N   * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  4..     C25


MULTIPLE R             .82253                   ANALYSIS OF VARIANCE    DF      SUM OF SQUARES        MEAN SQUARE           F
R SQUARE               .67656                   REGRESSION              4.         57660.31764        14415.07941        39.74265
ADJUSTED R SQUARE      .65953                   RESIDUAL               76.         27566.00335          362.71057
STANDARD ERROR       19.04496


------------------ VARIABLES IN THE EQUATION ------------------      ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE                 B       BETA   STD ERROR B         F      VARIABLE         BETA IN     PARTIAL   TOLERANCE           F

C30           .4177306E-04     .92329        .00000   102.070      C2               -.08429     -.14369      .94009       1.581
C19              -68.49691    -.32770      18.87546    13.169      C3          999999.99999 99999.99999      .00000   99999.999
C16               26.85623     .23264       7.78723    11.894      C4                .06193      .10765      .97722        .879
C25               19.49574     .18889       6.84517     8.112      C5          999999.99999 99999.99999      .00000   99999.999
(CONSTANT)        31.59163                                         C6               -.01227     -.02136      .98091        .034
                                                                   C7          999999.99999 99999.99999      .00000   99999.999
                                                                   C8                .10465      .18293      .98827       2.597
                                                                   C9               -.06193     -.10765      .97722        .879
                                                                   C10         999999.99999 99999.99999      .00000   99999.999
                                                                   C11         999999.99999 99999.99999      .00000   99999.999
                                                                   C12         999999.99999 99999.99999      .00000   99999.999
                                                                   C13         999999.99999 99999.99999      .00000   99999.999
                                                                   C14         999999.99999 99999.99999      .00000   99999.999
                                                                   C15         999999.99999 99999.99999      .00000   99999.999
                                                                   C17              -.06990     -.12157      .97841       1.125
                                                                   C18               .04901      .08543      .98264        .551
                                                                   C20              -.01793     -.03141      .99303        .074
                                                                   C21               .03900      .06402      .87140        .309
                                                                   C22              -.00479     -.00777      .85281        .005
                                                                   C23              -.02261     -.03923      .97362        .116
                                                                   C24              -.02669     -.04535      .93351        .155
                                                                   C26               .12625      .21610      .94771       3.674
                                                                   C27               .02736      .04711      .95866        .167
                                                                   C28              -.13993     -.24283      .97398       4.699
                                                                   C29               .04701      .08195      .98292        .507
                                                                   C31               .14449      .15520      .37317       1.851
                                                                   C32              -.06325     -.11030      .98371        .924
                                                                   C33               .17562      .29583      .91770       7.193
                                                                   C34               .03130      .05425      .97146        .221
                                                                   C35               .08322      .13681      .87407       1.431
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  5..    C33


MULTIPLE R             .83956                    ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE               .70486                    REGRESSION                5.        60072.70580        12014.54116         35.82350
ADJUSTED R SQUARE      .68519                    RESIDUAL                 75.        25153.61518          335.38154
STANDARD ERROR       18.31343


----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE            B               BETA      STD ERROR B        F       VARIABLE        BETA IN       PARTIAL    TOLERANCE          F

C30           .4107262E-04        .90781         .00000     106.258      C2             -.04691       -.08148       .89050          .495
C19          -62.16714          -.29741       18.30324      11.536      C3         999999.99999   99999.99999      .00000     99999.999
C16           23.95727           .20753        7.56573      10.027      C4              .06111        .11119       .97720          .926
C25           22.95635           .22241        6.70751      11.713      C5         999999.99999   99999.99999      .00000     99999.999
C33           12.99958           .17562        4.84703       7.193      C6             -.01256       -.02291       .98091          .039
(CONSTANT)    30.71037                                                  C7         999999.99999   99999.99999      .00000     99999.999
                                                                        C8              .11090        .20281       .98698         3.174
                                                                        C9             -.06111       -.11119       .97720          .926
                                                                        C10        999999.99999   99999.99999      .00000     99999.999
                                                                        C11        999999.99999   99999.99999      .00000     99999.999
                                                                        C12        999999.99999   99999.99999      .00000     99999.999
                                                                        C13        999999.99999   99999.99999      .00000     99999.999
                                                                        C14        999999.99999   99999.99999      .00000     99999.999
                                                                        C15        999999.99999   99999.99999      .00000     99999.999
                                                                        C17            -.04862       -.08777       .96188          .574
                                                                        C18             .03990        .07270       .97974          .393
                                                                        C20            -.03022       -.05528       .98790          .227
                                                                        C21             .05399        .09247       .86565          .638
                                                                        C22            -.02268       -.03838       .84478          .109
                                                                        C23             .01390        .02468       .93047          .045
                                                                        C24            -.01386       -.02457       .92838          .045
                                                                        C26             .08322        .14275       .86841         1.539
                                                                        C27             .01915        .03447       .95644          .088
                                                                        C28            -.13074       -.23713       .97089         4.409
                                                                        C29             .05040        .09196       .98254          .631
                                                                        C31             .13921        .15651       .37303         1.858
                                                                        C32             .00770        .01282       .81787          .012
                                                                        C34             .07427        .13116       .92056         1.295
                                                                        C35             .10767        .18380       .86013         2.587
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FILE   STUDY5   (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  6..    C28


MULTIPLE R             .84939                    ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE               .72146                    REGRESSION                6.        61487.15016        10247.85836        31.94473
ADJUSTED R SQUARE      .69887                    RESIDUAL                 74.        23739.17083          320.79961
STANDARD ERROR       17.91088


----------------- VARIABLES IN THE EQUATION -----------------            ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE            B            BETA      STD ERROR B          F         VARIABLE        BETA IN       PARTIAL   TOLERANCE          F

C30          .4142304E-04       .91555         .00000     112.785         C2              -.04732       -.08461      .89049          .526
C19          -65.16674        -.31176       17.95783      13.169         C3         999999.99999   99999.99999      .00000     99999.999
C16           25.28013         .21899        7.42620      11.588         C4               .09295        .17013      .93320         2.176
C25           21.36383         .20698        6.60377      10.466         C5         999999.99999   99999.99999      .00000     99999.999
C33           12.43794         .16804        4.74802       6.862         C6              -.04709       -.08570      .92255          .540
C28          -14.21492        -.13074        6.76968       4.409         C7         999999.99999   99999.99999      .00000     99999.999
(CONSTANT)    31.11160                                                   C8               .09937        .18619      .97789         2.622
                                                                         C9              -.09295       -.17013      .93320         2.176
                                                                         C10        999999.99999   99999.99999      .00000     99999.999
                                                                         C11        999999.99999   99999.99999      .00000     99999.999
                                                                         C12        999999.99999   99999.99999      .00000     99999.999
                                                                         C13        999999.99999   99999.99999      .00000     99999.999
                                                                         C14        999999.99999   99999.99999      .00000     99999.999
                                                                         C15        999999.99999   99999.99999      .00000     99999.999
                                                                         C17             -.05938       -.11001      .95586          .894
                                                                         C18              .02698        .05033      .96966          .185
                                                                         C20             -.03818       -.07176      .98430          .378
                                                                         C21              .02378        .04083      .82104          .122
                                                                         C22             -.03814       -.06603      .83509          .320
                                                                         C23             -.00338       -.00612      .91499          .003
                                                                         C24             -.01984       -.03619      .92654          .096
                                                                         C26              .06010        .10436      .83980          .804
                                                                         C27              .01159        .02145      .95327          .034
                                                                         C29              .05376        .10093      .98189          .751
                                                                         C31              .11732        .13493      .36847         1.354
                                                                         C32             -.00150       -.00256      .81446          .000
                                                                         C34              .07192        .13072      .92028         1.269
                                                                         C35              .09763        .17105      .85511         2.200
```

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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  7..    C8


MULTIPLE R           .85505                     ANALYSIS OF VARIANCE    DF      SUM OF SQUARES      MEAN SQUARE             F
R SQUARE             .73111                     REGRESSION               7.        62310.14899       8901.44986           28.35578
ADJUSTED R SQUARE    .70533                     RESIDUAL                73.        22916.17199        313.92016
STANDARD ERROR     17.71779


---------------- VARIABLES IN THE EQUATION -----------------             ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE           B          BETA     STD ERROR B        F              VARIABLE     BETA IN     PARTIAL   TOLERANCE            F

C30          .4144646E-04     .91607        .00000     115.385           C2            -.11958     -.19372      .70568        2.807
C19         -64.11453        -.30673      17.77612      13.009           C3       999999.99999 99999.99999      .00000    99999.999
C16          24.41311         .21147       7.36563      10.986           C4             .07359      .13350      .88478        1.306
C25          22.29776         .21603       6.55800      11.561           C5       999999.99999 99999.99999      .00000    99999.999
C33          12.75460         .17231       4.70091       7.362           C6            -.02823     -.05128      .88753         .190
C28         -13.16955        -.12113       6.72775       3.832           C7       999999.99999 99999.99999      .00000    99999.999
C8           14.87719         .09937       9.18821       2.622           C9            -.07359     -.13350      .88478        1.306
(CONSTANT)   30.84117                                                    C10      999999.99999 99999.99999      .00000    99999.999
                                                                         C11      999999.99999 99999.99999      .00000    99999.999
                                                                         C12      999999.99999 99999.99999      .00000    99999.999
                                                                         C13      999999.99999 99999.99999      .00000    99999.999
                                                                         C14      999999.99999 99999.99999      .00000    99999.999
                                                                         C15      999999.99999 99999.99999      .00000    99999.999
                                                                         C17           -.05383     -.10133      .95275         .747
                                                                         C18            .03538      .06696      .96316         .324
                                                                         C20           -.03342     -.06386      .98196         .295
                                                                         C21           -.03750     -.05734      .62864         .238
                                                                         C22           -.02873     -.05043      .82838         .184
                                                                         C23            .00747      .01370      .90494         .014
                                                                         C24           -.01616     -.02998      .92532         .065
                                                                         C26            .07770      .13580      .82136        1.353
                                                                         C27            .01630      .03065      .95122         .068
                                                                         C29            .04652      .08863      .97626         .570
                                                                         C31            .05904      .06252      .30152         .282
                                                                         C32           -.01178     -.02040      .80735         .030
                                                                         C34            .08314      .15303      .91084        1.726
                                                                         C35            .08131      .14268      .82810        1.496
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                                                                                    04/25/88        PAGE     1
SPSS BATCH SYSTEM

SPSS FOR ND-500, VERSION M, RELEASE 8.0A, OCTOBER 15, 1979
DEFAULT SPACE ALLOCATION..      ALLOWS FOR..    81 TRANSFORMATIONS
WORKSPACE     57344 BYTES                      327 RECODE VALUES + LAG VARIABLES
TRANSPACE      8192 BYTES                     1314 IF/COMPUTE OPERATIONS
LABELSPACE    32768 BYTES                    32768 BYTES MEMORY RESIDENT FILE SPACE

                 1 RUN NAME             COMMERCIAL2
                 2 FILE NAME            STUDY6
                 3 VARIABLE LIST        C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,
                 4                      C15,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,
                 5                      C27,C28,C29,C30,C31,C32,C33,C34,C35,
                 6 INPUT MEDIUM         DISK
                 7 N OF CASES           54
                 8 INPUT FORMAT         FREEFIELD
                 9 REGRESSION           VARIABLES = C1 TO C35
                10                      REGRESSION = C1 WITH C2 TO C35 RESID=0/
                11 STATISTICS           ALL

 ***** REGRESSION PROBLEM REQUIRES  21840 BYTES WORKSPACE, NOT INCLUDING RESIDUALS *****

                12 READ INPUT DATA
```

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VARIABLE            MEAN      STANDARD DEV      CASES

C1               62.9815           41.1250         54
C2                 .3333             .4758         54
C3                 .2593             .4423         54
C4                 .0556             .2312         54
C5                 .0370             .1906         54
C6                 .0000             .0000         54
C7                 .0000             .0000         54
C8                 .0000             .0000         54
C9                 .7963             .4065         54
C10                .0185             .1361         54
C11                .0370             .1906         54
C12                .0000             .0000         54
C13                .0185             .1361         54
C14                .0185             .1361         54
C15                .0185             .1361         54
C16                .7963             .4065         54
C17                .0556             .2312         54
C18                .0370             .1906         54
C19                .0185             .1361         54
C20                .0741             .2644         54
C21                .3148             .4688         54
C22                .0741             .2644         54
C23                .1111             .3172         54
C24                .0185             .1361         54
C25                .0000             .0000         54
C26                .1296             .3390         54
C27                .0556             .2312         54
C28                .1111             .3172         54
C29               1.4444             .5016         54
C30         1477541.6296      1933613.4458         54
C31          243014.7778      1061036.3703         54
C32                .1111             .3172         54
C33                .2407             .4315         54
C34                .0926             .2926         54
C35                .0370             .1906         54
```

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FILE    STUDY6   (CREATION DATE = 04/25/88)


CORRELATION COEFFICIENTS

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.



                C1        C2        C3        C4        C5        C6        C7        C8        C9        C10       C11       C12

C1          1.00000   -.20216    .02412    .11322    .47904  99.00000  99.00000  99.00000   -.33203   -.09097   -.08655  99.00000
C2          -.20216   1.00000   -.32869    .00000   -.13868  99.00000  99.00000  99.00000    .16256   -.09713    .06934  99.00000
C3           .02412   -.32869   1.00000   -.14349   -.11602  99.00000  99.00000  99.00000   -.12047   -.08126    .10774  99.00000
C4           .11322    .00000   -.14349   1.00000   -.04757  99.00000  99.00000  99.00000   -.47953   -.03331   -.04757  99.00000
C5           .47904   -.13868   -.11602   -.04757   1.00000  99.00000  99.00000  99.00000   -.38775   -.02694   -.03846  99.00000
C6         99.00000  99.00000  99.00000  99.00000  99.00000   1.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C7         99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C8         99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000  99.00000  99.00000  99.00000  99.00000
C9          -.33203    .16256   -.12047   -.47953   -.38775  99.00000  99.00000  99.00000   1.00000   -.27158   -.38775  99.00000
C10         -.09097   -.09713   -.08126   -.03331   -.02694  99.00000  99.00000  99.00000   -.27158   1.00000   -.02694  99.00000
C11         -.08655    .06934    .10774   -.04757   -.03846  99.00000  99.00000  99.00000   -.38775   -.02694   1.00000  99.00000
C12        99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000
C13          .08435   -.09713   -.08126    .56635   -.02694  99.00000  99.00000  99.00000   -.27158   -.01887   -.02694  99.00000
C14         -.09097   -.09713   -.08126   -.03331    .70040  99.00000  99.00000  99.00000   -.27158   -.01887   -.02694  99.00000
C15          .76201   -.09713   -.08126   -.03331    .70040  99.00000  99.00000  99.00000   -.27158   -.01887   -.02694  99.00000
C16          .23338    .06503   -.12047    .12267    .09919  99.00000  99.00000  99.00000   -.14165    .06947   -.14428  99.00000
C17         -.11101   -.17150   -.14349   -.05882   -.04757  99.00000  99.00000  99.00000    .12267   -.03331   -.04757  99.00000
C18         -.03361    .06934   -.11602   -.04757   -.03846  99.00000  99.00000  99.00000    .09919   -.02694   -.03846  99.00000
C19         -.08422   -.09713   -.08126   -.03331   -.02694  99.00000  99.00000  99.00000    .06947   -.01887   -.02694  99.00000
C20         -.11615   -.05000    .15538   -.06860   -.05547  99.00000  99.00000  99.00000    .14306   -.03885   -.05547  99.00000
C21          .04728    .11278    .05392    .18374    .07820  99.00000  99.00000  99.00000   -.35017   -.09311    .28933  99.00000
C22          .15806   -.20000   -.00598    .24010   -.05547  99.00000  99.00000  99.00000   -.03251   -.03885   -.05547  99.00000
C23          .10429    .12500    .05976   -.08575   -.06934  99.00000  99.00000  99.00000    .03251   -.04856   -.06934  99.00000
C24         -.05051   -.09713   -.08126   -.03331   -.02694  99.00000  99.00000  99.00000    .06947   -.01887   -.02694  99.00000
C25        99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C26         -.19604    .07797    .02330   -.09360   -.07569  99.00000  99.00000  99.00000    .19519   -.05301   -.07569  99.00000
C27         -.08918    .17150   -.14349   -.05882   -.04757  99.00000  99.00000  99.00000    .12267   -.03331   -.04757  99.00000
C28          .22434   -.12500    .05976   -.08575    .24268  99.00000  99.00000  99.00000   -.11379    .38851   -.06934  99.00000
C29          .03791    .00000   -.10394   -.21693    .21926  99.00000  99.00000  99.00000    .08225   -.12286    .02193  99.00000
C30          .76796   -.41195    .07768    .09598    .33834  99.00000  99.00000  99.00000   -.46005   -.04867   -.04391  99.00000
C31          .82419   -.12709   -.08023   -.04846    .67736  99.00000  99.00000  99.00000   -.27124   -.02472   -.04382  99.00000
C32         -.08083    .00000   -.20917    .17150   -.06934  99.00000  99.00000  99.00000    .03251   -.04856   -.06934  99.00000
C33          .41275    .06126    .16107    .05253    .11893  99.00000  99.00000  99.00000   -.14539   -.07735    .11893  99.00000
C34         -.05160    .04518   -.18898   -.07748   -.06265  99.00000  99.00000  99.00000    .16157   -.04388   -.06265  99.00000
C35         -.08174   -.13868    .33150   -.04757   -.03846  99.00000  99.00000  99.00000    .09919   -.02694   -.03846  99.00000
```

| | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 | C21 | C22 | C23 | C24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | .08435 | -.09097 | .76201 | .23338 | -.11101 | -.03361 | -.08422 | -.11615 | .04728 | .15806 | .10429 | -.05051 |
| C2 | -.09713 | -.09713 | -.09713 | .06503 | -.17150 | .06934 | -.09713 | -.05000 | .11278 | -.20000 | .12500 | -.09713 |
| C3 | -.08126 | -.08126 | -.08126 | -.12047 | -.14349 | -.11602 | -.08126 | .15538 | .05392 | -.00598 | .05976 | -.08126 |
| C4 | .56635 | -.03331 | -.03331 | .12267 | -.05882 | -.04757 | -.03331 | -.06860 | .18374 | .24010 | -.08575 | -.03331 |
| C5 | -.02694 | .70040 | .70040 | .09919 | -.04757 | -.03846 | -.02694 | -.05547 | .07820 | -.05547 | -.06934 | -.02694 |
| C6 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C7 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C8 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C9 | -.27158 | -.27158 | -.27158 | -.14165 | .12267 | .09919 | .06947 | .14306 | -.35017 | -.03251 | .03251 | .06947 |
| C10 | -.01887 | -.01887 | -.01887 | .06947 | -.03331 | -.02694 | -.01887 | -.03885 | -.09311 | -.03885 | -.04856 | -.01887 |
| C11 | -.02694 | -.02694 | -.02694 | -.14428 | -.04757 | -.03846 | -.02694 | -.05547 | .28933 | -.05547 | -.06934 | -.02694 |
| C12 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C13 | 1.00000 | -.01887 | -.01887 | .06947 | -.03331 | -.02694 | -.01887 | -.03885 | .20265 | -.03885 | -.04856 | -.01887 |
| C14 | -.01887 | 1.00000 | -.01887 | .06947 | -.03331 | -.02694 | -.01887 | -.03885 | .20265 | -.03885 | -.04856 | -.01887 |
| C15 | -.01887 | -.01887 | 1.00000 | .06947 | -.03331 | -.02694 | -.01887 | -.03885 | -.09311 | -.03885 | -.04856 | -.01887 |
| C16 | .06947 | .06947 | .06947 | 1.00000 | -.27879 | .09919 | -.27158 | -.20808 | -.05317 | .14306 | .03251 | .06947 |
| C17 | -.03331 | -.03331 | -.03331 | -.27879 | 1.00000 | -.04757 | -.03331 | -.06860 | -.16440 | -.06860 | -.08575 | -.03331 |
| C18 | -.02694 | -.02694 | -.02694 | .09919 | -.04757 | 1.00000 | -.02694 | -.05547 | -.13293 | -.05547 | -.06934 | -.02694 |
| C19 | -.01887 | -.01887 | -.01887 | -.27158 | -.03331 | -.02694 | 1.00000 | -.03885 | -.09311 | -.03885 | -.04856 | -.01887 |
| C20 | -.03885 | -.03885 | -.03885 | -.20808 | -.06860 | -.05547 | -.03885 | 1.00000 | -.19172 | -.08000 | -.10000 | -.03885 |
| C21 | .20265 | .20265 | -.09311 | -.05317 | -.16440 | -.13293 | -.09311 | -.19172 | 1.00000 | -.19172 | -.23965 | -.09311 |
| C22 | -.03885 | -.03885 | -.03885 | .14306 | -.06860 | -.05547 | -.03885 | -.08000 | -.19172 | 1.00000 | -.10000 | -.03885 |
| C23 | -.04856 | -.04856 | -.04856 | .03251 | -.08575 | -.06934 | -.04856 | -.10000 | -.23965 | -.10000 | 1.00000 | -.04856 |
| C24 | -.01887 | -.01887 | -.01887 | .06947 | -.03331 | -.02694 | -.01887 | -.03885 | -.09311 | -.03885 | -.04856 | 1.00000 |
| C25 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C26 | -.05301 | -.05301 | -.05301 | .19519 | -.09360 | -.07569 | -.05301 | -.10916 | -.26159 | -.10916 | -.13644 | -.05301 |
| C27 | -.03331 | -.03331 | -.03331 | .12267 | -.05882 | -.04757 | -.03331 | -.06860 | -.16440 | -.06860 | -.08575 | -.03331 |
| C28 | -.04856 | -.04856 | .38851 | .03251 | -.08575 | -.06934 | -.04856 | -.10000 | -.23965 | -.10000 | -.12500 | -.04856 |
| C29 | -.12286 | .15357 | .15357 | -.01028 | -.05423 | .21926 | .15357 | .03162 | -.04458 | -.11068 | .03953 | .15357 |
| C30 | .11597 | -.06563 | .53958 | .18221 | .03088 | -.12197 | .02067 | -.15989 | .00824 | .14848 | .18260 | .04536 |
| C31 | -.03176 | -.02841 | .97726 | .10720 | -.05232 | -.04288 | -.03055 | -.06173 | -.06976 | -.04643 | -.05740 | -.03044 |
| C32 | -.04856 | -.04856 | -.04856 | -.11379 | .42875 | -.06934 | -.04856 | -.10000 | -.11278 | .35000 | -.12500 | -.04856 |
| C33 | -.07735 | -.07735 | .24394 | .06971 | -.13657 | -.11043 | -.07735 | -.15927 | .17789 | .17152 | .07657 | -.07735 |
| C34 | -.04388 | -.04388 | -.04388 | .16157 | -.07748 | -.06265 | -.04388 | .39754 | -.07897 | -.09035 | -.11294 | -.04388 |
| C35 | -.02694 | -.02694 | -.02694 | .09919 | -.04757 | -.03846 | -.02694 | -.05547 | -.13293 | -.05547 | -.06934 | -.02694 |

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FILE    STUDY6   (CREATION DATE = 04/25/88)



            C25        C26        C27        C28        C29        C30        C31        C32        C33        C34        C35

C1        99.00000    -.19604    -.08918     .22434     .03791     .76796     .82419    -.08083     .41275    -.05160    -.08174
C2        99.00000     .07797     .17150    -.12500     .00000    -.41195    -.12709     .00000     .06126     .04518    -.13868
C3        99.00000     .02330    -.14349     .05976    -.10394     .07768    -.08023    -.20917     .16107    -.18898     .33150
C4        99.00000    -.09360    -.05882    -.08575    -.21693     .09598    -.04846     .17150     .05253    -.07748    -.04757
C5        99.00000    -.07569    -.04757     .24268     .21926     .33834     .67736    -.06934     .11893    -.06265    -.03846
C6        99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C7        99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C8        99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C9        99.00000     .19519     .12267    -.11379     .08225    -.46005    -.27124     .03251    -.14539     .16157     .09919
C10       99.00000    -.05301    -.03331     .38851    -.12286    -.04867    -.02472    -.04856    -.07735    -.04388    -.02694
C11       99.00000    -.07569    -.04757    -.06934     .02193    -.04391    -.04382    -.06934     .11893    -.06265    -.03846
C12       99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C13       99.00000    -.05301    -.03331    -.04856    -.12286     .11597    -.03176    -.04856    -.07735    -.04388    -.02694
C14       99.00000    -.05301    -.03331    -.04856     .15357    -.06563    -.02841    -.04856    -.07735    -.04388    -.02694
C15       99.00000    -.05301    -.03331     .38851     .15357     .53958     .97726    -.04856     .24394    -.04388    -.02694
C16       99.00000     .19519     .12267     .03251    -.01028     .18221     .10720    -.11379     .06971     .16157     .09919
C17       99.00000    -.09360    -.05882    -.08575    -.05423     .03088    -.05232     .42875    -.13657    -.07748    -.04757
C18       99.00000    -.07569    -.04757    -.06934     .21926    -.12197    -.04288    -.06934    -.11043    -.06265    -.03846
C19       99.00000    -.05301    -.03331    -.04856     .15357     .02067    -.03055    -.04856    -.07735    -.04388    -.02694
C20       99.00000    -.10916    -.06860    -.10000     .03162    -.15989    -.06173    -.10000    -.15927     .39754    -.05547
C21       99.00000    -.26159    -.16440    -.23965    -.04458     .00824    -.06976    -.11278     .17789    -.07897    -.13293
C22       99.00000    -.10916    -.06860    -.10000    -.11068     .14848    -.04643     .35000     .17152    -.09035    -.05547
C23       99.00000    -.13644    -.08575    -.12500     .03953     .18260    -.05740    -.12500     .07657    -.11294    -.06934
C24       99.00000    -.05301    -.03331    -.04856     .15357     .04536    -.03044    -.04856    -.07735    -.04388    -.02694
C25        1.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C26       99.00000    1.00000    -.09360    -.13644    -.01233    -.20710    -.08164    -.13644    -.21731     .06692     .21624
C27       99.00000    -.09360    1.00000    -.08575    -.05423    -.16103    -.00591     .17150    -.13657     .20144    -.04757
C28       99.00000    -.13644    -.08575    1.00000    -.07906     .17591     .43225    -.12500     .21440    -.11294     .24268
C29       99.00000    -.01233    -.05423    -.07906    1.00000     .06449     .12694    -.07906    -.15497    -.15714     .21926
C30       99.00000    -.20710    -.16103     .17591     .06449    1.00000     .60063     .01833     .13339    -.19044    -.12422
C31       99.00000    -.08164    -.00591     .43225     .12694     .60063    1.00000    -.05371     .31458    -.04161    -.04393
C32       99.00000    -.13644     .17150    -.12500    -.07906     .01833    -.05371    1.00000    -.19908    -.11294    -.06934
C33       99.00000    -.21731    -.13657     .21440    -.15497     .13339     .31458    -.19908    1.00000    -.17987    -.11043
C34       99.00000     .06692     .20144    -.11294    -.15714    -.19044    -.04161    -.11294    -.17987    1.00000    -.06265
C35       99.00000     .21624    -.04757     .24268     .21926    -.12422    -.04393    -.06934    -.11043    -.06265    1.00000
```

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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                 REGRESSION LIST  1
DEPENDENT VARIABLE..   C1

VARIABLE(S) ENTERED ON STEP NUMBER  1..    C31


MULTIPLE R          .82419                    ANALYSIS OF VARIANCE   DF     SUM OF SQUARES       MEAN SQUARE           F
R SQUARE            .67928                    REGRESSION             1.        60889.00197       60889.00197         110.13741
ADJUSTED R SQUARE   .67312                    RESIDUAL              52.        28747.97951         552.84576
STANDARD ERROR    23.51267


----------------- VARIABLES IN THE EQUATION -----------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE           B         BETA     STD ERROR B        F             VARIABLE    BETA IN     PARTIAL  TOLERANCE         F

C31          .3194488E-04    .82419       .00000    110.137            C2          -.09901     -.17342     .98385        1.581
(CONSTANT)   55.21840                                                  C3           .09084      .15988     .99356        1.338
                                                                       C4           .15351      .27075     .99765        4.034
                                                                       C5          -.14641     -.19019     .54118        1.914
                                                                       C6     999999.99999 99999.99999     .00000    99999.999
                                                                       C7     999999.99999 99999.99999     .00000    99999.999
                                                                       C8     999999.99999 99999.99999     .00000    99999.999
                                                                       C9          -.11709     -.19900     .92643        2.103
                                                                       C10         -.07064     -.12469     .99939         .805
                                                                       C11         -.05054     -.08916     .99808         .409
                                                                       C12    999999.99999 99999.99999     .00000    99999.999
                                                                       C13          .11063      .19526     .99899        2.021
                                                                       C14         -.06761     -.11933     .99919         .737
                                                                       C15         -.96624     -.36176     .04496        7.680
                                                                       C16          .14671      .25757     .98851        3.624
                                                                       C17         -.06807     -.12004     .99726         .746
                                                                       C18          .00174      .00306     .99816         .000
                                                                       C19         -.05910     -.10431     .99907         .561
                                                                       C20         -.06553     -.11549     .99619         .689
                                                                       C21          .10529      .18546     .99513        1.817
                                                                       C22          .19676      .34706     .99784        6.984
                                                                       C23          .15210      .26814     .99671        3.951
                                                                       C24         -.02544     -.04491     .99907         .103
                                                                       C25    999999.99999 99999.99999     .00000    99999.999
                                                                       C26         -.12961     -.22810     .99333        2.799
                                                                       C27         -.08432     -.14889     .99997        1.156
                                                                       C28         -.16223     -.25832     .81316        3.646
                                                                       C29         -.06781     -.11877     .98389         .730
                                                                       C30          .42695      .60277     .63924       29.105
                                                                       C32         -.03667     -.06466     .99712         .214
                                                                       C33          .17034      .28551     .90104        4.526
                                                                       C34         -.01734     -.03059     .99827         .048
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C35          -.04562     -.08048      .99807        .332
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *    VARIABLE LIST  1
                                                                                                                 REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  2..    C30


MULTIPLE R            .89208                    ANALYSIS OF VARIANCE    DF      SUM OF SQUARES        MEAN SQUARE             F
R SQUARE              .79581                    REGRESSION               2.        71334.12222        35667.06111            99.38448
ADJUSTED R SQUARE     .78780                    RESIDUAL                51.        18302.85926          358.87959
STANDARD ERROR      18.94412

----------------- VARIABLES IN THE EQUATION ------------------            ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE           B          BETA     STD ERROR B        F               VARIABLE      BETA IN     PARTIAL   TOLERANCE         F

C31          .2200530E-04     .56774         .00000      51.464           C2             .05681      .11298      .80764         .646
C30          .9080670E-05     .42695         .00000      29.105           C3             .03769      .08209      .96878         .339
(CONSTANT)   44.21680                                                     C4             .10250      .22376      .97318        2.635
                                                                          C5            -.09363     -.15139      .53384        1.173
                                                                          C6       999999.99999 99999.99999      .00000    99999.999
                                                                          C7       999999.99999 99999.99999      .00000    99999.999
                                                                          C8       999999.99999 99999.99999      .00000    99999.999
                                                                          C9             .02333      .04584      .78831         .105
                                                                          C10           -.05629     -.12441      .99760         .786
                                                                          C11           -.04303     -.09512      .99760         .457
                                                                          C12      999999.99999 99999.99999      .00000    99999.999
                                                                          C13            .05447      .11875      .97046         .715
                                                                          C14           -.04703     -.10384      .99550         .545
                                                                          C15           -.55984     -.25221      .04144        3.397
                                                                          C16            .09798      .21319      .96679        2.381
                                                                          C17           -.09533     -.21003      .99119        2.308
                                                                          C18            .04352      .09553      .98368         .461
                                                                          C19           -.07596     -.16782      .99668        1.449
                                                                          C20           -.01320     -.02882      .97259         .042
                                                                          C21            .08411      .18531      .99120        1.778
                                                                          C22            .12751      .27492      .94918        4.088
                                                                          C23            .06384      .13572      .92299         .938
                                                                          C24           -.05298     -.11682      .99274         .692
                                                                          C25      999999.99999 99999.99999      .00000    99999.999
                                                                          C26           -.06420     -.13878      .95425         .982
                                                                          C27           -.01777     -.03855      .96117         .074
                                                                          C28           -.11989     -.23763      .80220        2.992
                                                                          C29           -.06272     -.13767      .98367         .966
                                                                          C32           -.05857     -.12916      .99311         .848
                                                                          C33            .19772      .41423      .89621       10.357
                                                                          C34            .05582      .12075      .95545         .740
                                                                          C35           -.00383     -.00840      .98310         .004
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COMMERCIAL2                                                                                   04/25/88        PAGE    9

FILE    STUDY6   (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                    REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  3..    C33


MULTIPLE R            .91151                   ANALYSIS OF VARIANCE     DF      SUM OF SQUARES       MEAN SQUARE            F
R SQUARE              .83085                   REGRESSION                3.        74474.69611       24824.89870     81.86397
ADJUSTED R SQUARE     .82070                   RESIDUAL                 50.        15162.28537         303.24571
STANDARD ERROR      17.41395


----------------- VARIABLES IN THE EQUATION -----------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE           B              BETA      STD ERROR B        F       VARIABLE         BETA IN     PARTIAL   TOLERANCE           F

C31          .1919442E-04       .49522          .00000      42.282      C2                 .03945      .08589      .80184        .364
C30          .9446167E-05       .44414          .00000      37.073      C3                -.00269     -.00630      .92536        .002
C33          18.84226           .19772         5.85498      10.357      C4                 .08714      .20826      .96628       2.222
(CONSTANT)   39.82375                                                   C5                -.05776     -.10153      .52266        .510
                                                                        C6            999999.99999 99999.99999    .00000   99999.999
                                                                        C7            999999.99999 99999.99999    .00000   99999.999
                                                                        C8            999999.99999 99999.99999    .00000   99999.999
                                                                        C9                 .04534      .09738      .78008        .469
                                                                        C10               -.04216     -.10209      .99173        .516
                                                                        C11               -.07039     -.16928      .97839       1.446
                                                                        C12           999999.99999 99999.99999    .00000   99999.999
                                                                        C13                .06604      .15790      .96701       1.253
                                                                        C14               -.03280     -.07932      .98962        .310
                                                                        C15               -.27058     -.12542      .03634        .783
                                                                        C16                .08874      .21189      .96441       2.303
                                                                        C17               -.07354     -.17669      .97651       1.579
                                                                        C18                .06552      .15699      .97131       1.238
                                                                        C19               -.06349     -.15375      .99206       1.186
                                                                        C20                .01786      .04227      .94731        .088
                                                                        C21                .04551      .10755      .94468        .573
                                                                        C22                .08983      .20766      .90390       2.208
                                                                        C23                .04015      .09305      .90862        .428
                                                                        C24               -.04076     -.09853      .98841        .480
                                                                        C25           999999.99999 99999.99999    .00000   99999.999
                                                                        C26               -.02277     -.05273      .90719        .137
                                                                        C27                .01309      .03081      .93660        .047
                                                                        C28               -.13840     -.30033      .79655       4.858
                                                                        C29               -.02440     -.05755      .94084        .163
                                                                        C32               -.02402     -.05717      .95784        .161
                                                                        C34                .09703      .22614      .91883       2.641
                                                                        C35                .01753      .04200      .97077        .087
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  4..    C28


MULTIPLE R              .91984                     ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE                .84610                     REGRESSION               4.         75842.28236        18960.57059          67.34964
ADJUSTED R SQUARE       .83354                     RESIDUAL                49.         13794.69912          281.52447
STANDARD ERROR        16.77869


----------------- VARIABLES IN THE EQUATION ------------------        ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE              B            BETA     STD ERROR B         F        VARIABLE        BETA IN       PARTIAL   TOLERANCE            F

C31         .2177883E-04         .56190          .00000    50.117        C2               .01921        .04336      .78384          .090
C30         .9080989E-05         .42697          .00000    36.458        C3               .01170        .02851      .91397          .039
C33          19.88923            .20871         5.66136    12.342        C4               .07962        .19911      .96252         1.982
C28         -17.94202           -.13840         8.14052     4.858        C5              -.07175       -.13181      .51937          .849
(CONSTANT)   41.47678                                                    C6         999999.99999   99999.99999      .00000     99999.999
                                                                         C7         999999.99999   99999.99999      .00000     99999.999
                                                                         C8         999999.99999   99999.99999      .00000     99999.999
                                                                         C9               .04032        .09071      .77905          .398
                                                                         C10              .01723        .03905      .79034          .073
                                                                         C11             -.07972       -.20050      .97339         2.010
                                                                         C12        999999.99999   99999.99999      .00000     99999.999
                                                                         C13              .06423        .16099      .96681         1.277
                                                                         C14             -.03802       -.09632      .98791          .450
                                                                         C15             -.42043       -.20000      .03483         2.000
                                                                         C16              .08845        .22141      .96440         2.474
                                                                         C17             -.08026       -.20189      .97387         2.040
                                                                         C18              .05790        .14517      .96750         1.033
                                                                         C19             -.06705       -.17017      .99127         1.431
                                                                         C20              .00660        .01630      .93978          .013
                                                                         C21              .01432        .03433      .88439          .057
                                                                         C22              .07927        .19139      .89724         1.825
                                                                         C23              .02810        .06797      .90043          .223
                                                                         C24             -.04389       -.11119      .98780          .601
                                                                         C25        999999.99999   99999.99999      .00000     99999.999
                                                                         C26             -.03948       -.09511      .89320          .438
                                                                         C27             -.00051       -.00126      .92596          .000
                                                                         C29             -.04287       -.10496      .92279          .535
                                                                         C32             -.03604       -.08954      .94960          .388
                                                                         C34              .08281        .20090      .90570         2.019
                                                                         C35              .05927        .14236      .88772          .993
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  5..    C16


MULTIPLE R             .92393                    ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE               .85365                    REGRESSION                5.        76518.52054        15303.70411       55.99573
ADJUSTED R SQUARE      .83840                    RESIDUAL                 48.        13118.46095          273.30127
STANDARD ERROR       16.53183


----------------- VARIABLES IN THE EQUATION ------------------            ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE            B             BETA      STD ERROR B          F          VARIABLE         BETA IN       PARTIAL    TOLERANCE           F

C31          .2185138E-04        .56377          .00000       51.957        C2                .00391        .00893       .76453         .004
C30          .8726463E-05        .41030          .00000       33.896        C3                .02636        .06508       .89217         .200
C33          19.45279            .20413         5.58496       12.132        C4                .07115        .18146       .95203        1.600
C28         -17.91228          -.13817          8.02077        4.987        C5               -.07959       -.14965       .51734        1.077
C16          8.947191            .08845         5.68797        2.474        C6          999999.99999   99999.99999      .00000    99999.999
(CONSTANT)   34.96012                                                       C7          999999.99999   99999.99999      .00000    99999.999
                                                                            C8          999999.99999   99999.99999      .00000    99999.999
                                                                            C9                .04656        .10722       .77609         .547
                                                                            C10               .00800        .01850       .78317         .016
                                                                            C11              -.06820       -.17394       .95211        1.466
                                                                            C12         999999.99999   99999.99999      .00000    99999.999
                                                                            C13               .05975        .15335       .96413        1.132
                                                                            C14              -.04599       -.11903       .98040         .675
                                                                            C15              -.36748       -.17783       .03427        1.535
                                                                            C17              -.05989       -.14796       .89323        1.052
                                                                            C18               .04712        .12010       .95083         .688
                                                                            C19              -.04635       -.11586       .91442         .639
                                                                            C20               .02348        .05852       .90937         .161
                                                                            C21               .02103        .05157       .87987         .125
                                                                            C22               .06981        .17175       .88582        1.428
                                                                            C23               .02883        .07151       .90037         .242
                                                                            C24              -.04985       -.12922       .98353         .798
                                                                            C25         999999.99999   99999.99999      .00000    99999.999
                                                                            C26              -.06828       -.16277       .83177        1.279
                                                                            C27              -.01624       -.04025       .89950         .076
                                                                            C29              -.04173       -.10477       .92264         .522
                                                                            C32              -.02629       -.06652       .93741         .209
                                                                            C34               .06592        .15998       .86187        1.235
                                                                            C35               .04743        .11568       .87072         .637
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SPSS BATCH SYSTEM                                                                          04/25/88        PAGE    1

SPSS FOR ND-500, VERSION M, RELEASE 8.0A, OCTOBER 15, 1979
DEFAULT SPACE ALLOCATION..     ALLOWS FOR..    81 TRANSFORMATIONS
WORKSPACE     57344 BYTES                     327 RECODE VALUES + LAG VARIABLES
TRANSPACE      8192 BYTES                    1314 IF/COMPUTE OPERATIONS
LABELSPACE    32768 BYTES                   32768 BYTES MEMORY RESIDENT FILE SPACE

                 1 RUN NAME            INDUS-EDUC-MEDIC
                 2 FILE NAME           STUDY9
                 3 VARIABLE LIST       C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,
                 4                     C15,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,
                 5                     C27,C28,C29,C30,C31,C32,C33,C34,C35,
                 6 INPUT MEDIUM        DISK
                 7 N OF CASES          77
                 8 INPUT FORMAT        FREEFIELD
                 9 REGRESSION          VARIABLES = C1 TO C35
                10                     REGRESSION = C1 WITH C2 TO C35 RESID=0/
                11 STATISTICS          ALL

 ***** REGRESSION PROBLEM REQUIRES  21840 BYTES WORKSPACE, NOT INCLUDING RESIDUALS *****


                12 READ INPUT DATA
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VARIABLE              MEAN      STANDARD DEV      CASES

C1                 59.3247           39.5383         77
C2                   .2727             .4483         77
C3                   .1039             .3071         77
C4                   .4545             .5012         77
C5                   .1039             .3071         77
C6                   .0000             .0000         77
C7                   .0130             .1140         77
C8                   .0000             .0000         77
C9                   .3896             .4909         77
C10                  .0130             .1140         77
C11                  .0000             .0000         77
C12                  .0000             .0000         77
C13                  .0000             .0000         77
C14                  .0519             .2234         77
C15                  .0260             .1601         77
C16                  .7662             .4260         77
C17                  .0519             .2234         77
C18                  .0519             .2234         77
C19                  .0000             .0000         77
C20                  .0649             .2480         77
C21                  .1429             .3522         77
C22                  .0130             .1140         77
C23                  .0909             .2894         77
C24                  .0390             .1948         77
C25                  .0779             .2698         77
C26                  .2597             .4414         77
C27                  .0519             .2234         77
C28                  .1299             .3384         77
C29                 1.4675             .5022         77
C30            768984.4026      1621967.9260         77
C31            211341.1299       876697.8072         77
C32                  .2338             .4260         77
C33                  .2338             .4260         77
C34                  .1299             .3384         77
C35                  .0130             .1140         77
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FILE    STUDY9   (CREATION DATE = 04/25/88)


CORRELATION COEFFICIENTS

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.



                C1         C2         C3         C4         C5         C6         C7         C8         C9        C10        C11        C12

C1         1.00000    -.00506    -.21627     .30453     .09796   99.00000     .04870   99.00000    -.30288    -.02139   99.00000   99.00000
C2         -.00506    1.00000    -.20851     .31944    -.11295   99.00000    -.07024   99.00000    -.19026    -.07024   99.00000   99.00000
C3         -.21627    -.20851    1.00000    -.31083    -.11594   99.00000    -.03906   99.00000     .16436    -.03906   99.00000   99.00000
C4          .30453     .31944    -.31083    1.00000    -.31083   99.00000    -.10471   99.00000    -.72932    -.10471   99.00000   99.00000
C5          .09796    -.11295    -.11594    -.31083    1.00000   99.00000    -.03906   99.00000    -.27204    -.03906   99.00000   99.00000
C6        99.00000   99.00000   99.00000   99.00000   99.00000    1.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C7          .04870    -.07024    -.03906    -.10471    -.03906   99.00000    1.00000   99.00000     .14358    -.01316   99.00000   99.00000
C8        99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000    1.00000   99.00000   99.00000   99.00000   99.00000
C9         -.30288    -.19026     .16436    -.72932    -.27204   99.00000     .14358   99.00000    1.00000    -.09164   99.00000   99.00000
C10        -.02139    -.07024    -.03906    -.10471    -.03906   99.00000    -.01316   99.00000    -.09164    1.00000   99.00000   99.00000
C11       99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000    1.00000   99.00000
C12       99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000    1.00000
C13       99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C14         .30348    -.14335    -.07971    -.21369     .68746   99.00000    -.02685   99.00000    -.18702    -.02685   99.00000   99.00000
C15        -.11567    -.10000     .47958    -.14907    -.05560   99.00000    -.01873   99.00000    -.13047    -.01873   99.00000   99.00000
C16         .26939    -.07516    -.21420     .13446     .08751   99.00000     .06336   99.00000    -.12503    -.20767   99.00000   99.00000
C17         .02488    -.14335    -.07971    -.09616    -.07971   99.00000    -.02685   99.00000     .17299    -.02685   99.00000   99.00000
C18         .10682    -.01195    -.07971     .02137    -.07971   99.00000    -.02685   99.00000     .05299    -.02685   99.00000   99.00000
C19       99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C20        -.07195    -.16137     .08300    -.02887    -.08973   99.00000    -.03023   99.00000     .11369    -.03023   99.00000   99.00000
C21         .21016     .08333     .10426     .14907    -.01738   99.00000    -.04683   99.00000    -.09785    -.04683   99.00000   99.00000
C22        -.11192    -.07024    -.03906    -.10471    -.03906   99.00000    -.01316   99.00000     .14358    -.01316   99.00000   99.00000
C23        -.15097    -.09221     .04038    -.28868     .04038   99.00000    -.03627   99.00000     .21054    -.03627   99.00000   99.00000
C24        -.14348     .02740     .15140    -.04901    -.06856   99.00000    -.02310   99.00000    -.02324    -.02310   99.00000   99.00000
C25        -.08134     .14835    -.09898     .22114     .05980   99.00000    -.03335   99.00000    -.23225    -.03335   99.00000   99.00000
C26         .14138     .10278    -.00756     .05407     .08950   99.00000     .19365   99.00000    -.16958     .19365   99.00000   99.00000
C27         .01594    -.14335     .11209    -.09616    -.07971   99.00000    -.02685   99.00000     .17299    -.02685   99.00000   99.00000
C28        -.13695     .02366    -.13155    -.04232     .12168   99.00000    -.04432   99.00000     .00823    -.04432   99.00000   99.00000
C29        -.16678    -.04782     .19277    -.22811     .02216   99.00000     .12241   99.00000     .10536     .12241   99.00000   99.00000
C30         .65374    -.16049    -.03572     .12967    -.01182   99.00000    -.03702   99.00000    -.12130     .04634   99.00000   99.00000
C31         .36836    -.12091     .20991     .03218    -.05962   99.00000    -.02768   99.00000     .01812    -.01124   99.00000   99.00000
C32         .08605     .00626    -.08751    -.07283    -.08751   99.00000    -.06336   99.00000     .12503     .20767   99.00000   99.00000
C33         .30010     .00626    -.18807     .23530     .01306   99.00000     .20767   99.00000    -.18959    -.06336   99.00000   99.00000
C34        -.06122     .11040    -.13155     .19044    -.13155   99.00000    -.04432   99.00000    -.07099    -.04432   99.00000   99.00000
C35        -.04475    -.07024     .33688    -.10471    -.03906   99.00000    -.01316   99.00000     .14358    -.01316   99.00000   99.00000
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|  | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 | C21 | C22 | C23 | C24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | 99.00000 | .30348 | -.11567 | .26939 | .02488 | .10682 | 99.00000 | -.07195 | .21016 | -.11192 | -.15097 | -.14348 |
| C2 | 99.00000 | -.14335 | -.10000 | -.07516 | -.14335 | -.01195 | 99.00000 | -.16137 | .08333 | -.07024 | -.09221 | .02740 |
| C3 | 99.00000 | -.07971 | .47958 | -.21420 | -.07971 | -.07971 | 99.00000 | .08300 | .10426 | -.03906 | .04038 | .15140 |
| C4 | 99.00000 | -.21369 | -.14907 | .13446 | -.09616 | .02137 | 99.00000 | -.02887 | .14907 | -.10471 | -.28868 | -.04901 |
| C5 | 99.00000 | .68746 | -.05560 | .08751 | -.07971 | -.07971 | 99.00000 | -.08973 | -.01738 | -.03906 | .04038 | -.06856 |
| C6 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C7 | 99.00000 | -.02685 | -.01873 | .06336 | -.02685 | -.02685 | 99.00000 | -.03023 | -.04683 | -.01316 | -.03627 | -.02310 |
| C8 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C9 | 99.00000 | -.18702 | -.13047 | -.12503 | .17299 | .05299 | 99.00000 | .11369 | -.09785 | .14358 | .21054 | -.02324 |
| C10 | 99.00000 | -.02685 | -.01873 | -.20767 | -.02685 | -.02685 | 99.00000 | -.03023 | -.04683 | -.01316 | -.03627 | -.02310 |
| C11 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C12 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C13 | 1.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C14 | 99.00000 | 1.00000 | -.03823 | -.00898 | -.05479 | -.05479 | 99.00000 | -.06169 | .07167 | -.02685 | .12954 | -.04713 |
| C15 | 99.00000 | -.03823 | 1.00000 | -.10272 | -.03823 | -.03823 | 99.00000 | -.04303 | -.06667 | -.01873 | .23238 | .38908 |
| C16 | 99.00000 | -.00898 | -.10272 | 1.00000 | -.00898 | .12929 | 99.00000 | .14556 | -.03758 | .06336 | -.25230 | -.04737 |
| C17 | 99.00000 | -.05479 | -.03823 | -.00898 | 1.00000 | -.05479 | 99.00000 | -.06169 | -.09556 | -.02685 | -.07402 | -.04713 |
| C18 | 99.00000 | -.05479 | -.03823 | .12929 | -.05479 | 1.00000 | 99.00000 | -.06169 | -.09556 | -.02685 | -.07402 | -.04713 |
| C19 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 1.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C20 | 99.00000 | -.06169 | -.04303 | .14556 | -.06169 | -.06169 | 99.00000 | 1.00000 | -.10758 | -.03023 | -.08333 | -.05306 |
| C21 | 99.00000 | .07167 | -.06667 | -.03758 | -.09556 | -.09556 | 99.00000 | -.10758 | 1.00000 | -.04683 | -.12910 | -.08220 |
| C22 | 99.00000 | -.02685 | -.01873 | .06336 | -.02685 | -.02685 | 99.00000 | -.03023 | -.04683 | 1.00000 | -.03627 | -.02310 |
| C23 | 99.00000 | .12954 | .23238 | -.25230 | -.07402 | -.07402 | 99.00000 | -.08333 | -.12910 | -.03627 | 1.00000 | -.06367 |
| C24 | 99.00000 | -.04713 | .38908 | -.04737 | -.04713 | -.04713 | 99.00000 | -.05306 | -.08220 | -.02310 | -.06367 | 1.00000 |
| C25 | 99.00000 | .15027 | -.04747 | -.29735 | -.06805 | -.06805 | 99.00000 | -.07661 | -.11868 | -.03335 | -.09193 | -.05853 |
| C26 | 99.00000 | -.00520 | -.09673 | .18722 | -.13866 | -.13866 | 99.00000 | -.15610 | -.24183 | -.06795 | -.18732 | -.11927 |
| C27 | 99.00000 | -.05479 | -.03823 | -.00898 | -.05479 | -.05479 | 99.00000 | -.06169 | -.09556 | -.02685 | -.07402 | -.04713 |
| C28 | 99.00000 | -.09043 | -.06309 | .12211 | -.09043 | -.09043 | 99.00000 | -.10181 | -.15772 | -.04432 | -.12217 | -.07779 |
| C29 | 99.00000 | -.10206 | .17427 | -.15895 | .01523 | -.10206 | 99.00000 | -.14130 | -.01063 | .12241 | .06585 | .08036 |
| C30 | 99.00000 | .07412 | -.01628 | .09494 | .22687 | -.01386 | 99.00000 | -.07381 | .22727 | -.04529 | .02955 | -.04370 |
| C31 | 99.00000 | -.02739 | -.01413 | -.08041 | -.00167 | -.04680 | 99.00000 | -.04667 | .37505 | -.02783 | -.05492 | -.04364 |
| C32 | 99.00000 | .00898 | -.09020 | -.12994 | -.12929 | .14725 | 99.00000 | -.14556 | .12527 | .20767 | .03881 | -.11121 |
| C33 | 99.00000 | .00898 | -.09020 | .08757 | .00898 | .00898 | 99.00000 | -.02102 | .03758 | -.06336 | -.06793 | -.11121 |
| C34 | 99.00000 | -.09043 | -.06309 | .12211 | .25774 | -.09043 | 99.00000 | .21176 | -.04732 | -.04432 | -.12217 | -.07779 |
| C35 | 99.00000 | -.02685 | -.01873 | .06336 | -.02685 | -.02685 | 99.00000 | .43529 | -.04683 | -.01316 | -.03627 | -.02310 |

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              C25       C26       C27       C28       C29       C30       C31       C32       C33       C34       C35

C1         -.08134    .14138    .01594   -.13695   -.16678    .65374    .36836    .08605    .30010   -.06122   -.04475
C2          .14835    .10278   -.14335    .02366   -.04782   -.16049   -.12091    .00626    .00626    .11040   -.07024
C3         -.09898   -.00756    .11209   -.13155    .19277   -.03572    .20991   -.08751   -.18807   -.13155    .33688
C4          .22114    .05407   -.09616   -.04232   -.22811    .12967    .03218   -.07283    .23530    .19044   -.10471
C5          .05980    .08950   -.07971    .12168    .02216   -.01182   -.05962   -.08751    .01306   -.13155   -.03906
C6        99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C7         -.03335    .19365   -.02685   -.04432    .12241   -.03702   -.02768   -.06336    .20767   -.04432   -.01316
C8        99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C9         -.23225   -.16958    .17299    .00823    .10536   -.12130    .01812    .12503   -.18959   -.07099    .14358
C10        -.03335    .19365   -.02685   -.04432    .12241    .04634   -.01124    .20767   -.06336   -.04432   -.01316
C11       99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C12       99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C13       99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C14         .15027   -.00520   -.05479   -.09043   -.10206    .07412   -.02739    .00898    .00898   -.09043   -.02685
C15        -.04747   -.09673   -.03823   -.06309    .17427   -.01628   -.01413   -.09020   -.09020   -.06309   -.01873
C16        -.29735    .18722   -.00898    .12211   -.15895    .09494   -.08041   -.12994    .08757    .12211    .06336
C17        -.06805   -.13866   -.05479   -.09043    .01523    .22687   -.00167   -.12929    .00898    .25774   -.02685
C18        -.06805   -.13866   -.05479   -.09043   -.10206   -.01386   -.04680    .14725    .00898   -.09043   -.02685
C19       99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000
C20        -.07661   -.15610   -.06169   -.10181   -.14130   -.07381   -.04667   -.14556   -.02102    .21176    .43529
C21        -.11868   -.24183   -.09556   -.15772   -.01063    .22727    .37505    .12527    .03758   -.04732   -.04683
C22        -.03335   -.06795   -.02685   -.04432    .12241   -.04529   -.02783    .20767   -.06336   -.04432   -.01316
C23        -.09193   -.18732   -.07402   -.12217    .06585    .02955   -.05492    .03881   -.06793   -.12217   -.03627
C24        -.05853   -.11927   -.04713   -.07779    .08036   -.04370   -.04364   -.11121   -.11121   -.07779   -.02310
C25        1.00000   -.17220   -.06805   -.11231   -.07819   -.08504   -.06856   -.04609    .06839   -.11231   -.03335
C26        -.17220   1.00000   -.13866   -.22884    .15727   -.07749   -.11788   -.04726    .09270    .03547   -.06795
C27        -.06805   -.13866   1.00000   -.09043    .01523   -.01947    .11163    .14725    .00898   -.09043   -.02685
C28        -.11231   -.22884   -.09043   1.00000   -.05229   -.11275   -.08946   -.12211   -.12211    .08060   -.04432
C29        -.07819    .15727    .01523   -.05229   1.00000   -.20968   -.01558    .22045   -.27156    .10257   -.10749
C30        -.08504   -.07749   -.01947   -.11275   -.20968   1.00000    .50082    .17820   -.03739   -.09328   -.00693
C31        -.06856   -.11788    .11163   -.08946   -.01558    .50082   1.00000    .04605    .00387   -.05208   -.01644
C32        -.04609   -.04726    .14725   -.12211    .22045    .17820    .04605   1.00000   -.30508   -.21339   -.06336
C33         .06839    .09270    .00898   -.12211   -.27156   -.03739    .00387   -.30508   1.00000   -.21339   -.06336
C34        -.11231    .03547   -.09043    .08060    .10257   -.09328   -.05208   -.21339   -.21339   1.00000   -.04432
C35        -.03335   -.06795   -.02685   -.04432   -.10749   -.00693   -.01644   -.06336   -.06336   -.04432   1.00000
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* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  1..    C30


MULTIPLE R              .65374                   ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE           F
R SQUARE                .42738                   REGRESSION                1.        50776.22991        50776.22991        55.97632
ADJUSTED R SQUARE       .41974                   RESIDUAL                 75.        68032.65321          907.10204
STANDARD ERROR        30.11813


----------------- VARIABLES IN THE EQUATION ------------------           ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE              B           BETA     STD ERROR B         F           VARIABLE       BETA IN      PARTIAL   TOLERANCE          F

C30           .1593607E-04       .65374          .00000       55.976      C2              .10249       .13369      .97424        1.347
(CONSTANT)    47.07009                                                    C3             -.19317      -.25511      .99872        5.151
                                                                          C4              .22352       .29289      .98319        6.944
                                                                          C5              .10570       .13967      .99986        1.472
                                                                          C6        999999.99999  99999.99999      .00000    99999.999
                                                                          C7              .07300       .09640      .99863         .694
                                                                          C8        999999.99999  99999.99999      .00000    99999.999
                                                                          C9             -.22692      -.29765      .98529        7.194
                                                                          C10            -.05179      -.06837      .99785         .348
                                                                          C11       999999.99999  99999.99999      .00000    99999.999
                                                                          C12       999999.99999  99999.99999      .00000    99999.999
                                                                          C13       999999.99999  99999.99999      .00000    99999.999
                                                                          C14             .25643       .33794      .99451        9.541
                                                                          C15            -.10506      -.13882      .99974        1.454
                                                                          C16             .20921       .27522      .99099        6.064
                                                                          C17            -.13013      -.16748      .94853        2.136
                                                                          C18             .11590       .15315      .99981        1.777
                                                                          C19       999999.99999  99999.99999      .00000    99999.999
                                                                          C20            -.02382      -.03140      .99455         .073
                                                                          C21             .06493       .08356      .94835         .520
                                                                          C22            -.08248      -.10888      .99795         .888
                                                                          C23            -.17044      -.22514      .99913        3.951
                                                                          C24            -.11513      -.15200      .99809        1.750
                                                                          C25            -.02594      -.03415      .99277         .086
                                                                          C26             .19320       .25454      .99399        5.127
                                                                          C27             .02868       .03790      .99962         .106
                                                                          C28            -.06406      -.08411      .98729         .527
                                                                          C29            -.03107      -.04014      .95603         .119
                                                                          C31             .05466       .06252      .74918         .290
                                                                          C32            -.03145      -.04089      .96824         .124
                                                                          C33             .32500       .42918      .99860       16.708
                                                                          C34            -.00024      -.00032      .99130         .000
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                                                    C35          -.04022     -.05316      .99995        .210
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* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                 REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  2..    C33


MULTIPLE R              .72997                    ANALYSIS OF VARIANCE    DF      SUM OF SQUARES        MEAN SQUARE           F
R SQUARE                .53285                    REGRESSION               2.        63307.64276        31653.82138       42.20415
ADJUSTED R SQUARE       .52023                    RESIDUAL                74.        55501.24035          750.01676
STANDARD ERROR        27.38643


----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE            B             BETA     STD ERROR B        F          VARIABLE        BETA IN       PARTIAL   TOLERANCE          F

C30          .1623228E-04        .66589        .00000      70.142        C2               .10241        .14789      .97424        1.632
C33          30.16386            .32500       7.37942      16.708        C3              -.13644       -.19588      .96280        2.913
(CONSTANT)   39.79102                                                    C4               .15313        .21553      .92543        3.556
                                                                         C5               .10161        .14865      .99970        1.649
                                                                         C6         999999.99999   99999.99999      .00000    99999.999
                                                                         C7               .00613        .00876      .95601         .006
                                                                         C8         999999.99999   99999.99999      .00000    99999.999
                                                                         C9              -.16937       -.24122      .94755        4.510
                                                                         C10             -.03184       -.04645      .99405         .158
                                                                         C11        999999.99999   99999.99999      .00000    99999.999
                                                                         C12        999999.99999   99999.99999      .00000    99999.999
                                                                         C13        999999.99999   99999.99999      .00000    99999.999
                                                                         C14              .25263        .36857      .99437       11.476
                                                                         C15             -.07617       -.11097      .99148         .910
                                                                         C16              .18084        .26228      .98267        5.393
                                                                         C17             -.13616       -.19399      .94822        2.854
                                                                         C18              .11316        .16555      .99974        2.057
                                                                         C19        999999.99999   99999.99999      .00000    99999.999
                                                                         C20             -.01606       -.02343      .99399         .040
                                                                         C21              .04925        .07010      .94622         .360
                                                                         C22             -.06156       -.08978      .99371         .593
                                                                         C23             -.14938       -.21797      .99466        3.641
                                                                         C24             -.07940       -.11531      .98534         .984
                                                                         C25             -.04749       -.06908      .98851         .350
                                                                         C26              .16518        .23997      .98592        4.460
                                                                         C27              .02600        .03804      .99955         .106
                                                                         C28             -.02284       -.03294      .97131         .079
                                                                         C29              .06960        .09542      .87786         .671
                                                                         C31              .04489        .05683      .74867         .237
                                                                         C32              .07569        .10384      .87906         .796
                                                                         C34              .07440        .10577      .94420         .826
                                                                         C35             -.01963       -.02866      .99590         .060
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FILE    STUDY9    (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  3..    C14


MULTIPLE R            .77221                        ANALYSIS OF VARIANCE      DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE              .59631                        REGRESSION                 3.        70847.25917        23615.75306       35.94436
ADJUSTED R SQUARE     .57972                        RESIDUAL                  73.        47961.62394          657.00855
STANDARD ERROR      25.63218


----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE            B              BETA      STD ERROR B        F          VARIABLE        BETA IN       PARTIAL    TOLERANCE          F

C30           .1577313E-04        .64706          .00000      75.186       C2               .13897        .21396       .95687          3.454
C33           29.88797            .32202         6.90721      18.724       C3              -.11749       -.18092       .95717          2.436
C14           44.71518            .25263        13.19975      11.476       C4               .22750        .33475       .87401          9.086
(CONSTANT)    37.88572                                                     C5              -.13808       -.15722       .52341          1.825
                                                                           C6         999999.99999   99999.99999       .00000      99999.999
                                                                           C7               .01315        .02022       .95531           .029
                                                                           C8         999999.99999   99999.99999       .00000      99999.999
                                                                           C9              -.12667       -.19086       .91649          2.722
                                                                           C10             -.02435       -.03820       .99317           .105
                                                                           C11        999999.99999   99999.99999       .00000      99999.999
                                                                           C12        999999.99999   99999.99999       .00000      99999.999
                                                                           C13        999999.99999   99999.99999       .00000      99999.999
                                                                           C15             -.06710       -.10509       .99018           .804
                                                                           C16              .18529        .28905       .98238          6.564
                                                                           C17             -.11767       -.17985       .94304          2.407
                                                                           C18              .12715        .19980       .99682          2.994
                                                                           C19        999999.99999   99999.99999       .00000      99999.999
                                                                           C20             -.00185       -.00290       .99084           .001
                                                                           C21              .03487        .05330       .94326           .205
                                                                           C22             -.05581       -.08753       .99319           .556
                                                                           C23             -.18499       -.28796       .97814          6.510
                                                                           C24             -.06861       -.10709       .98352           .835
                                                                           C25             -.08952       -.13834       .96410          1.405
                                                                           C26              .16531        .25834       .98592          5.149
                                                                           C27              .03963        .06226       .99668           .280
                                                                           C28             -.00190       -.00293       .96478           .001
                                                                           C29              .09430        .13851       .87089          1.408
                                                                           C31              .06713        .09116       .74445           .603
                                                                           C32              .07590        .11200       .87906           .915
                                                                           C34              .09673        .14742       .93760          1.600
                                                                           C35             -.01315       -.02064       .99524           .031
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  4..    C4


MULTIPLE R             .80097                    ANALYSIS OF VARIANCE      DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE               .64155                    REGRESSION                 4.        76221.69040        19055.42260         32.21603
ADJUSTED R SQUARE      .62163                    RESIDUAL                  72.        42587.19272          591.48879
STANDARD ERROR       24.32054


----------------- VARIABLES IN THE EQUATION -----------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE            B             BETA      STD ERROR B         F          VARIABLE        BETA IN       PARTIAL   TOLERANCE            F

C30          .1491015E-04       .61166           .00000    72.628          C2               .07368        .11324      .84671          .922
C33          24.75361           .26670          6.77148    13.363          C3              -.05673       -.08832      .86895          .558
C14          53.87231           .30436         12.88746    17.474          C5              -.07428       -.08735      .49563          .546
C4           17.94710           .22750          5.95389     9.086          C6         999999.99999   99999.99999      .00000     99999.999
(CONSTANT)   31.11611                                                      C7               .05169        .08315      .92762          .494
                                                                           C8         999999.99999   99999.99999      .00000     99999.999
                                                                           C9               .12972        .12722      .34479         1.168
                                                                           C10             -.00085       -.00141      .98112          .000
                                                                           C11        999999.99999   99999.99999      .00000     99999.999
                                                                           C12        999999.99999   99999.99999      .00000     99999.999
                                                                           C13        999999.99999   99999.99999      .00000     99999.999
                                                                           C15             -.03724       -.06125      .96985          .267
                                                                           C16              .16476        .27127      .97176         5.640
                                                                           C17             -.08461       -.13545      .91861         1.327
                                                                           C18              .12513        .20866      .99673         3.232
                                                                           C19        999999.99999   99999.99999      .00000     99999.999
                                                                           C20              .00419        .00696      .99005          .003
                                                                           C21              .00582        .00936      .92654          .006
                                                                           C22             -.03589       -.05947      .98426          .252
                                                                           C23             -.13729       -.21854      .90817         3.561
                                                                           C24             -.06267       -.10377      .98275          .773
                                                                           C25             -.16110       -.25406      .89149         4.899
                                                                           C26              .15585        .25820      .98386         5.072
                                                                           C27              .06509        .10782      .98339          .835
                                                                           C28              .00179        .00294      .96450          .001
                                                                           C29              .13842        .21243      .84423         3.355
                                                                           C31              .08366        .12031      .74124         1.043
                                                                           C32              .08226        .12877      .87838         1.197
                                                                           C34              .04228        .06602      .87373          .311
                                                                           C35              .00851        .01410      .98506          .014
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INDUS-EDUC-MEDIC                                                                     04/25/88       PAGE   11

FILE    STUDY9   (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  5..     C16


MULTIPLE R              .81727                ANALYSIS OF VARIANCE     DF       SUM OF SQUARES          MEAN SQUARE             F
R SQUARE                .66793                REGRESSION                5.         79355.68554          15871.13711         28.56171
ADJUSTED R SQUARE       .64454                RESIDUAL                 71.         39453.19757            555.67884
STANDARD ERROR        23.57284


----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE            B              BETA      STD ERROR B          F         VARIABLE        BETA IN       PARTIAL    TOLERANCE            F

C30          .1457887E-04         .59807          .00000       73.414       C2               .09350        .14845       .83714        1.577
C33          23.76508             .25605         6.57649       13.058       C3              -.02644       -.04208       .84121         .124
C14          53.64241             .30306        12.49163       18.441       C5              -.11628       -.14004       .48167        1.400
C4           16.51430             .20934         5.80230        8.101       C6         999999.99999   99999.99999       .00000    99999.999
C16          15.29162             .16476         6.43897        5.640       C7               .04038        .06733       .92331         .319
(CONSTANT)   20.54820                                                       C8         999999.99999   99999.99999       .00000    99999.999
                                                                            C9               .13989        .14245       .34434        1.450
                                                                            C10              .03334        .05614       .94173         .221
                                                                            C11        999999.99999   99999.99999       .00000    99999.999
                                                                            C12        999999.99999   99999.99999       .00000    99999.999
                                                                            C13        999999.99999   99999.99999       .00000    99999.999
                                                                            C15             -.02401       -.04089       .96346         .117
                                                                            C17             -.08155       -.13561       .91831        1.311
                                                                            C18              .10577        .18169       .97989        2.390
                                                                            C19        999999.99999   99999.99999       .00000    99999.999
                                                                            C20             -.02246       -.03828       .96479         .103
                                                                            C21              .01942        .03233       .92064         .073
                                                                            C22             -.05013       -.08600       .97718         .522
                                                                            C23             -.10310       -.16577       .85857        1.978
                                                                            C24             -.05757       -.09898       .98177         .693
                                                                            C25             -.11559       -.17782       .78590        2.286
                                                                            C26              .12991        .21971       .94989        3.551
                                                                            C27              .06458        .11113       .98338         .875
                                                                            C28             -.02344       -.03951       .94296         .109
                                                                            C29              .15944        .25273       .83432        4.776
                                                                            C31              .11400        .16845       .72509        2.044
                                                                            C32              .10590        .17085       .86431        2.105
                                                                            C34              .01938        .03115       .85808         .068
                                                                            C35             -.00487       -.00836       .97851         .005
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FILE    STUDY9    (CREATION DATE = 04/29/83)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  6..    C29


MULTIPLE R            .83014                ANALYSIS OF VARIANCE    DF      SUM OF SQUARES       MEAN SQUARE            F
R SQUARE              .68914                REGRESSION               6.       81875.66425       13645.94404       25.86333
ADJUSTED R SQUARE     .66249                RESIDUAL                70.       36933.21887         527.61741
STANDARD ERROR      22.96992


----------------- VARIABLES IN THE EQUATION ------------------         ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE            B            BETA     STD ERROR B        F         VARIABLE       BETA IN      PARTIAL    TOLERANCE          F

C30        .1527223E-04        .62651          .00000     81.851        C2            .10297       .16870      .83439         2.021
C33         27.16594           .29270         6.59452     16.970        C3           -.03819      -.06266      .83676          .272
C14         57.10298           .32261        12.27470     21.642        C5           -.13940      -.17259      .47655         2.119
C4          18.57112           .23541         5.73169     10.498        C6      999999.99999  99999.99999     .00000     99999.999
C16         16.78622           .18086         6.31144      7.074        C7            .01499       .02546      .89651          .045
C29         12.55263           .15944         5.74375      4.776        C8      999999.99999  99999.99999     .00000     99999.999
(CONSTANT)  -1.461282                                                   C9            .20224       .20792      .32858         3.118
                                                                        C10           .02083       .03613      .93504          .090
                                                                        C11     999999.99999  99999.99999     .00000     99999.999
                                                                        C12     999999.99999  99999.99999     .00000     99999.999
                                                                        C13     999999.99999  99999.99999     .00000     99999.999
                                                                        C15          -.04307      -.07524      .94863          .393
                                                                        C17          -.08766      -.15055      .91689         1.600
                                                                        C18           .12212       .21568      .96960         3.366
                                                                        C19     999999.99999  99999.99999     .00000     99999.999
                                                                        C20           .00358       .00621      .93529          .003
                                                                        C21           .00770       .01321      .91511          .012
                                                                        C22          -.06471      -.11421      .96836          .912
                                                                        C23          -.10286      -.17094      .85857         2.077
                                                                        C24          -.06224      -.11056      .98080          .854
                                                                        C25          -.10527      -.16703      .78252         1.980
                                                                        C26           .10246       .17490      .90577         2.177
                                                                        C27           .06613       .11761      .98327          .968
                                                                        C28          -.00558      -.00964      .92945          .006
                                                                        C31           .09972       .15171      .71948         1.625
                                                                        C32           .07947       .13020      .83431         1.190
                                                                        C34           .00655       .01084      .85233          .008
                                                                        C35           .01792       .03142      .95591          .068
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FILE    STUDY9   (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *    VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  7..    C18


MULTIPLE R            .83881                ANALYSIS OF VARIANCE     DF     SUM OF SQUARES      MEAN SQUARE           F
R SQUARE              .70360                REGRESSION                7.       83593.74760      11941.96394      23.39890
ADJUSTED R SQUARE     .67353                RESIDUAL                 69.       35215.13552        510.36428
STANDARD ERROR      22.59124


---------------- VARIABLES IN THE EQUATION -----------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE          B            BETA     STD ERROR B        F          VARIABLE        BETA IN       PARTIAL   TOLERANCE          F

C30          .1539653E-04     .63161        .00000      85.858        C2               .10551        .17699      .83408        2.199
C33          27.47636         .29604       6.48801      17.935        C3              -.03078       -.05163      .83403         .182
C14          58.54074         .33073      12.09775      23.416        C5              -.12746       -.16119      .47405        1.814
C4           18.78795         .23816       5.63844      11.103        C6         999999.99999   99999.99999      .00000    99999.999
C16          15.42110         .16615       6.25182       6.084        C7               .01785        .03103      .89606         .066
C29          13.62010         .17300       5.67894       5.752        C8         999999.99999   99999.99999      .00000    99999.999
C18          21.61621         .12212      11.78142       3.366        C9               .18811        .19754      .32688        2.761
(CONSTANT)  -3.446139                                                 C10              .01981        .03519      .93498         .084
                                                                      C11         999999.99999   99999.99999      .00000    99999.999
                                                                      C12         999999.99999   99999.99999      .00000    99999.999
                                                                      C13         999999.99999   99999.99999      .00000    99999.999
                                                                      C15             -.04108       -.07348      .94838         .369
                                                                      C17             -.08146       -.14309      .91450        1.421
                                                                      C19         999999.99999   99999.99999      .00000    99999.999
                                                                      C20              .01727        .03051      .92428         .063
                                                                      C21              .01763        .03087      .90953         .065
                                                                      C22             -.06115       -.11048      .96752         .840
                                                                      C23             -.09804       -.16675      .85732        1.945
                                                                      C24             -.05717       -.10389      .97902         .742
                                                                      C25             -.10106       -.16413      .78174        1.883
                                                                      C26              .12475        .21550      .88451        3.312
                                                                      C27              .07365        .13390      .97975        1.241
                                                                      C28              .01117        .01961      .91309         .026
                                                                      C31              .10299        .16041      .71911        1.796
                                                                      C32              .05465        .08973      .79885         .552
                                                                      C34              .02192        .03692      .84091         .093
                                                                      C35              .02471        .04430      .95306         .134
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                 REGRESSION LIST  1
DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  8..     C26


MULTIPLE R              .84697                  ANALYSIS OF VARIANCE     DF       SUM OF SQUARES         MEAN SQUARE              F
R SQUARE                .71736                  REGRESSION                8.         85229.13863         10653.64233          21.57395
ADJUSTED R SQUARE       .68411                  RESIDUAL                 68.         33579.74449           493.81977
STANDARD ERROR        22.22206


----------------- VARIABLES IN THE EQUATION ------------------            ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE            B            BETA     STD ERROR B        F            VARIABLE        BETA IN      PARTIAL    TOLERANCE           F

C30          .1558575E-04      .63937          .00000     90.563          C2               .09158       .15621       .82239         1.676
C33          26.14670          .28171         6.42367     16.568          C3              -.03519      -.06042       .83306          .245
C14          57.93588          .32732        11.90468     23.684          C5              -.14184      -.18312       .47108         2.325
C4           18.17602          .23040         5.55648     10.700          C6         999999.99999  99999.99999       .00000     99999.999
C16          12.78080          .13771         6.31849      4.092          C7              -.00028      -.00050       .87690          .000
C29          11.52310          .14637         5.70375      4.081          C8         999999.99999  99999.99999       .00000     99999.999
C18          24.88577          .14060        11.72733      4.503          C9               .22942       .24316       .31751         4.211
C26          11.17514          .12475         6.14082      3.312          C10             -.01136      -.02000       .87605          .027
(CONSTANT)  -.9432243                                                     C11        999999.99999  99999.99999       .00000     99999.999
                                                                          C12        999999.99999  99999.99999       .00000     99999.999
                                                                          C13        999999.99999  99999.99999       .00000     99999.999
                                                                          C15             -.02870      -.05229       .93785          .184
                                                                          C17             -.06540      -.11644       .89615          .921
                                                                          C19        999999.99999  99999.99999       .00000     99999.999
                                                                          C20              .04121       .07325       .89277          .361
                                                                          C21              .05564       .09598       .84080          .623
                                                                          C22             -.04873      -.08962       .95603          .543
                                                                          C23             -.08084      -.13920       .83799         1.324
                                                                          C24             -.04279      -.07900       .96322          .421
                                                                          C25             -.08249      -.13554       .76299         1.254
                                                                          C27              .09403       .17301       .95672         2.067
                                                                          C28              .04855       .08391       .84422          .475
                                                                          C31              .11676       .18545       .71297         2.386
                                                                          C32              .05349       .08992       .79879          .546
                                                                          C34              .02465       .04251       .84053          .121
                                                                          C35              .03125       .05731       .95031          .221
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INDUS-EDUC-MEDIC
                                                                                    04/25/88        PAGE   15
FILE    STUDY9    (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
DEPENDENT VARIABLE..    C1                                                                                          REGRESSION LIST  1

VARIABLE(S) ENTERED ON STEP NUMBER  9..     C9


MULTIPLE R               .85678            ANALYSIS OF VARIANCE    DF      SUM OF SQUARES        MEAN SQUARE              F
R SQUARE                 .73408            REGRESSION               9.        87214.66586         9690.51843         20.55011
ADJUSTED R SQUARE        .69835            RESIDUAL                67.        31594.21725          471.55548
STANDARD ERROR         21.71533


----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE            B           BETA     STD ERROR B        F           VARIABLE        BETA IN      PARTIAL    TOLERANCE          F

C30          .1568047E-04     .64326         .00000      95.915         C2               .08598       .15108      .82106        1.542
C33           26.42104        .28467        6.27862      17.708         C3              -.00666      -.01155      .79861         .009
C14           73.03123        .41260       13.76409      28.153         C5              -.03014      -.03001      .26369         .060
C4            33.04466        .41888        9.05469      13.319         C6         999999.99999  99999.99999      .00000    99999.999
C16           13.14206        .14160        6.17692       4.527         C7              -.02309      -.04139      .85420         .113
C29           13.52457        .17179        5.65839       5.713         C8         999999.99999  99999.99999      .00000    99999.999
C18           23.80272        .13448       11.47206       4.305         C10              .03265       .05657      .79842         .212
C26           13.29007        .14836        6.08866       4.764         C11        999999.99999  99999.99999      .00000    99999.999
C9            18.47974        .22942        9.00584       4.211         C12        999999.99999  99999.99999      .00000    99999.999
(CONSTANT)   -19.52984                                                  C13        999999.99999  99999.99999      .00000    99999.999
                                                                        C15              .04512       .07451      .72503         .368
                                                                        C17             -.08366      -.15239      .88230        1.569
                                                                        C19        999999.99999  99999.99999      .00000    99999.999
                                                                        C20              .03163       .05781      .88824         .221
                                                                        C21              .04724       .08385      .83769         .467
                                                                        C22             -.06238      -.11770      .94672         .927
                                                                        C23             -.08274      -.14686      .83784        1.455
                                                                        C24             -.02284      -.04293      .93987         .122
                                                                        C25             -.07520      -.12722      .76104        1.086
                                                                        C27              .08015       .15106      .94456        1.541
                                                                        C28              .07479       .13129      .81956        1.158
                                                                        C31              .10785       .17627      .71033        2.116
                                                                        C32              .03101       .05304      .77810         .186
                                                                        C34              .00647       .01140      .82638         .009
                                                                        C35              .02420       .04567      .94757         .138
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER 10..    C31


MULTIPLE R             .86159                    ANALYSIS OF VARIANCE    DF      SUM OF SQUARES        MEAN SQUARE            F
R SQUARE               .74234                    REGRESSION              10.       88196.27856         8819.62786        19.01489
ADJUSTED R SQUARE      .70330                    RESIDUAL                66.       30612.60456          463.82734
STANDARD ERROR       21.53665


----------------- VARIABLES IN THE EQUATION ------------------            ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE           B            BETA     STD ERROR B        F            VARIABLE        BETA IN       PARTIAL   TOLERANCE          F

C30         .1426933E-04      .58537         .00000      58.807          C2                .09042        .16126      .81956        1.735
C33         25.66526          .27653        6.24859      16.870          C3               -.03540       -.06020      .74497         .236
C14         73.66065          .41616       13.65769      29.088          C5               -.03747       -.03787      .26325         .093
C4          32.64734          .41384        8.98434      13.205          C6          999999.99999   99999.99999      .00000    99999.999
C16         14.12063          .15214        6.16291       5.250          C7               -.01981       -.03605      .85323         .085
C29         12.60978          .16017        5.64695       4.986          C8          999999.99999   99999.99999      .00000    99999.999
C18         24.45728          .13818       11.38656       4.614          C10               .03803        .06685      .79627         .292
C26         14.00418          .15633        6.05848       5.343          C11         999999.99999   99999.99999      .00000    99999.999
C9          17.68791          .21959        8.94831       3.907          C12         999999.99999   99999.99999      .00000    99999.999
C31         .4863881E-05      .10785         .00000       2.116          C13         999999.99999   99999.99999      .00000    99999.999
(CONSTANT) -18.46636                                                     C15               .04787        .08028      .72457         .422
                                                                         C17              -.06759       -.12275      .84984         .994
                                                                         C19         999999.99999   99999.99999      .00000    99999.999
                                                                         C20               .03172        .05889      .88824         .226
                                                                         C21               .01924        .03310      .76266         .071
                                                                         C22              -.06005       -.11508      .94612         .872
                                                                         C23              -.06945       -.12384      .81914        1.012
                                                                         C24              -.01912       -.03649      .93836         .087
                                                                         C25              -.06869       -.11781      .75779         .915
                                                                         C27               .07038        .13386      .93221        1.186
                                                                         C28               .07801        .13906      .81875        1.282
                                                                         C32               .04095        .07085      .77136         .328
                                                                         C34               .00528        .00945      .82627         .006
                                                                         C35               .02479        .04754      .94753         .147
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SPSS BATCH SYSTEM                                                                    04/25/88        PAGE    1

SPSS FOR ND-500, VERSION M, RELEASE 8.0A, OCTOBER 15, 1979
DEFAULT SPACE ALLOCATION..     ALLOWS FOR..    81 TRANSFORMATIONS
WORKSPACE     57344 BYTES                     327 RECODE VALUES + LAG VARIABLES
TRANSPACE      8192 BYTES                    1314 IF/COMPUTE OPERATIONS
LABELSPACE    32768 BYTES                   32768 BYTES MEMORY RESIDENT FILE SPACE

                 1 RUN NAME              FULL-STEPWISE-REGRESSION
                 2 FILE NAME             STUDYDWS
                 3 VARIABLE LIST         C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,
                 4                       C15,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,
                 5                       C27,C28,C29,C30,C31,C32,C33,C34,C35,
                 6 INPUT MEDIUM          DISK
                 7 N OF CASES            212
                 8 INPUT FORMAT          FREEFIELD
                 9 REGRESSION            VARIABLES = C1 TO C35
                10                       REGRESSION = C1 WITH C2 TO C35 RESID=0/
                11 STATISTICS            ALL

 ***** REGRESSION PROBLEM REQUIRES  21840 BYTES WORKSPACE, NOT INCLUDING RESIDUALS *****


                12 READ INPUT DATA
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FILE    STUDYDWS (CREATION DATE = 04/25/88)


VARIABLE              MEAN      STANDARD DEV      CASES

C1                 67.9057           38.4074        212
C2                   .2594             .4394        212
C3                   .1038             .3057        212
C4                   .4009             .4912        212
C5                   .0472             .2125        212
C6                   .1179             .3233        212
C7                   .0047             .0687        212
C8                   .0189             .1364        212
C9                   .5047             .5012        212
C10                  .0094             .0969        212
C11                  .0094             .0969        212
C12                  .0000             .0000        212
C13                  .0047             .0687        212
C14                  .0236             .1521        212
C15                  .0142             .1184        212
C16                  .8302             .3764        212
C17                  .0425             .2021        212
C18                  .0519             .2223        212
C19                  .0142             .1184        212
C20                  .0519             .2223        212
C21                  .2028             .4031        212
C22                  .0660             .2489        212
C23                  .0896             .2863        212
C24                  .0283             .1662        212
C25                  .0708             .2570        212
C26                  .1934             .3959        212
C27                  .0472             .2125        212
C28                  .1132             .3176        212
C29                 1.5142             .5010        212
C30            863681.1557      1490931.1210        212
C31            151313.1226       756083.0801        212
C32                  .2217             .4164        212
C33                  .2453             .4313        212
C34                  .1274             .3342        212
C35                  .0425             .2021        212
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CORRELATION COEFFICIENTS

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.



             C1        C2        C3        C4        C5        C6        C7        C8        C9        C10       C11       C12

C1        1.00000   -.12324   -.12672    .20372    .12249    .10014    .01454    .08992   -.22010   -.06089   -.05834  99.00000
C2        -.12324   1.00000   -.16612    .10865   -.08093   -.11631   -.04075    .23430   -.03787   -.05776    .05356  99.00000
C3        -.12672   -.16612   1.00000   -.27838   -.07571   -.12442   -.02343   -.04719    .12053   -.03321    .12679  99.00000
C4         .20372    .10865   -.27838   1.00000   -.18203   -.29913   -.05632    .16951   -.82586   -.07984   -.07984  99.00000
C5         .12249   -.08093   -.07571   -.18203   1.00000   -.08135   -.01532   -.03085   -.22461   -.02171   -.02171  99.00000
C6         .10014   -.11631   -.12442   -.29913   -.08135   1.00000   -.02517   -.05070    .36220   -.03568   -.03568  99.00000
C7         .01454   -.04075   -.02343   -.05632   -.01532   -.02517   1.00000   -.00955    .06820   -.00672   -.00672  99.00000
C8         .08992    .23430   -.04719    .16951   -.03085   -.05070   -.00955   1.00000   -.13999   -.01353   -.01353  99.00000
C9        -.22010   -.03787    .12053   -.82586   -.22461    .36220    .06820   -.13999   1.00000   -.09852   -.09852  99.00000
C10       -.06089   -.05776   -.03321   -.07984   -.02171   -.03568   -.00672   -.01353   -.09852   1.00000   -.00952  99.00000
C11       -.05834    .05356    .12679   -.07984   -.02171   -.03568   -.00672   -.01353   -.09852   -.00952   1.00000  99.00000
C12      99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000  99.00000   1.00000
C13        .03610   -.04075   -.02343    .08415   -.01532   -.02517   -.00474   -.00955   -.06950   -.00672   -.00672  99.00000
C14        .11152   -.09199   -.05289   -.12715    .69851   -.05683   -.01070   -.02155   -.15689   -.01517   -.01517  99.00000
C15        .15455   -.07091    .22114   -.09802    .16172   -.04381   -.00825   -.01661   -.12094   -.01169   -.01169  99.00000
C16        .30512    .00973   -.17566    .11366    .04137    .08746    .03114    .06272   -.09624   -.08582   -.08582  99.00000
C17       -.03673   -.07125   -.07165   -.12452   -.04685    .06809   -.01450   -.02920    .16179   -.02055   -.02055  99.00000
C18        .04331   -.04142   -.07960    .02559   -.05205   -.01960   -.01610   -.03244    .01906   -.02283   -.02283  99.00000
C19        .12328   -.07091   -.04077    .06496   -.02666   -.04381   -.00825   -.01661   -.04107   -.01169   -.01169  99.00000
C20       -.09877   -.08994    .12960   -.01781   -.05205   -.08554   -.01610   -.03244    .06160   -.02283   -.02283  99.00000
C21        .14728    .20993    .09761    .04211   -.00157   -.00257   -.03473    .27492   -.08688   -.04923    .19347  99.00000
C22       -.03553   -.07072   -.02820    .01499   -.05916   -.03833   -.01831   -.03687    .03548   -.02595   -.02595  99.00000
C23       -.06000    .00267    .05568   -.15560    .00808    .03888   -.02160   -.04351    .11264   -.03062   -.03062  99.00000
C24       -.12652   -.03612    .03520   -.08158   -.03797    .11399   -.01175   -.02367    .05528   -.01666   -.01666  99.00000
C25        .04485   -.03742   -.09390    .14961    .02538    .01318   -.01900   -.03827   -.13138   -.02693   -.02693  99.00000
C26        .01928    .00990   -.00998    .01368    .06005    .00611    .14059   -.06790   -.04045    .07576   -.04779  99.00000
C27       -.05113   -.03017   -.00275   -.04583   -.04950   -.01237   -.01532   -.03085    .08690   -.02171   -.02171  99.00000
C28       -.03797   -.00769   -.02395    .04184    .13117   -.13064   -.02460   -.04955   -.09270    .11913   -.03487  99.00000
C29       -.03367    .01554   -.00963   -.05205    .03822    .03354    .06692    .06544    .01861   -.00276   -.00276  99.00000
C30        .61253   -.19531    .10405   -.03162    .09921   -.08800   -.02846   -.03682   -.09583    .01612    .01213  99.00000
C31        .46427   -.07964    .08333   -.03245    .19777   -.06278   -.01371   -.00204   -.05096   -.00795   -.01852  99.00000
C32        .04192   -.00501   -.14438    .14263   -.06519   -.01910   -.03674    .09291   -.08453    .06538   -.05208  99.00000
C33        .29182   -.03728   -.01424    .09286    .02830    .02950    .12076    .00152   -.09309   -.05563    .05777  99.00000
C34       -.05150    .06441   -.13000    .09165   -.08500   -.05194   -.02630   -.05298   -.01775   -.03728   -.03728  99.00000
C35        .09088   -.01788    .15850    .01869   -.04685    .06809   -.01450    .14275    .02141   -.02055   -.02055  99.00000
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FILE    STUDYDWS (CREATION DATE = 04/25/88)



             C13        C14        C15        C16        C17        C18        C19        C20        C21        C22        C23        C24

C1         .03610     .11152     .15455     .30512    -.03673     .04331     .12328    -.09877     .14728    -.03553    -.06000    -.12652
C2        -.04075    -.09199    -.07091     .00973    -.07125    -.04142    -.07091    -.08994     .20993    -.07072     .00267    -.03612
C3        -.02343    -.05289     .22114    -.17566    -.07165    -.07960    -.04077     .12960     .09761    -.02820     .05568     .03520
C4         .08415    -.12715    -.09802     .11366    -.12452     .02559     .06496    -.01781     .04211     .01499    -.15560    -.08158
C5        -.01532     .69851     .16172     .04137    -.04685    -.05205    -.02666    -.05205    -.00157    -.05916     .00808    -.03797
C6        -.02517    -.05683    -.04381     .08746     .06809    -.01960    -.04381    -.08554    -.00257    -.03833     .03888     .11399
C7        -.00474    -.01070    -.00825     .03114    -.01450    -.01610    -.00825    -.01610    -.03473    -.01831    -.02160    -.01175
C8        -.00955    -.02155    -.01661     .06272    -.02920    -.03244    -.01661    -.03244     .27492    -.03687    -.04351    -.02367
C9        -.06950    -.15689    -.12094    -.09624     .16179     .01906    -.04107     .06160    -.08688     .03548     .11264     .05528
C10       -.00672    -.01517    -.01169    -.08582    -.02055    -.02283    -.01169    -.02283    -.04923    -.02595    -.03062    -.01666
C11       -.00672    -.01517    -.01169    -.08582    -.02055    -.02283    -.01169    -.02283     .19347    -.02595    -.03062    -.01666
C12      99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000   99.00000
C13       1.00000    -.01070    -.00825     .03114    -.01450    -.01610    -.00825    -.01610     .13648    -.01831    -.02160    -.01175
C14       -.01070    1.00000    -.01862    -.01250    -.03272    -.03636    -.01862    -.03636     .07621    -.04133     .06006    -.02652
C15       -.00825    -.01862    1.00000    -.05218    -.02523    -.02803    -.01435    -.02803    -.06043    -.03186     .10222     .22037
C16        .03114    -.01250    -.05218    1.00000    -.09170     .10580    -.05218    -.00748     .00943    -.03150    -.07801    -.07433
C17       -.01450    -.03272    -.02523    -.09170    1.00000    -.04926    -.02523    -.04926    -.10621    -.05599    -.06606    -.03593
C18       -.01610    -.03636    -.02803     .10580    -.04926    1.00000    -.02803    -.05473    -.11800    -.06221    -.07340    -.03992
C19       -.00825    -.01862    -.01435    -.05218    -.02523    -.02803    1.00000    -.02803    -.06043    -.03186    -.03759    -.02045
C20       -.01610    -.03636    -.02803    -.00748    -.04926    -.05473    -.02803    1.00000    -.11800    -.06221    -.07340    -.03992
C21        .13648     .07621    -.06043     .00943    -.10621    -.11800    -.06043    -.11800    1.00000    -.13413    -.15827    -.08609
C22       -.01831    -.04133    -.03186    -.03150    -.05599    -.06221    -.03186    -.06221    -.13413    1.00000    -.08343    -.04538
C23       -.02160     .06006     .10222    -.07801    -.06606    -.07340    -.03759    -.07340    -.15827    -.08343    1.00000    -.05355
C24       -.01175    -.02652     .22037    -.07433    -.03593    -.03992    -.02045    -.03992    -.08609    -.04538    -.05355    1.00000
C25       -.01900     .07834    -.03306    -.16917    -.05810    -.06455    -.03306    -.06455    -.13919    -.07337    -.08658    -.04709
C26       -.03371     .00260    -.05867     .15784    -.10310    -.11455    -.05867    -.11455    -.24699    -.13020    -.15364    -.08357
C27       -.01532    -.03458    -.02666    -.01789    -.04685    -.05205    -.02666    -.05205    -.11223    -.05916    -.06981    -.03797
C28       -.02460    -.05553     .08324     .08229    -.07523    -.08358    -.04281    -.08358    -.18023    -.09501    -.11210    -.06098
C29       -.07082    -.03550     .11646    -.06260     .01744    -.02790     .03656    -.07045    -.02602    -.00753     .00764     .05208
C30        .10327     .02843     .20481     .10558     .13384    -.06130     .17330    -.07983     .14643    -.00358     .07526    -.02777
C31       -.01381    -.01208     .39919    -.01442    -.01365    -.04137    -.01929    -.03735     .13361    -.04379    -.04416    -.03127
C32       -.03674    -.00812    -.06394    -.03081     .05659     .02874     .03220    -.12485    -.01505     .08670     .03132    -.02261
C33       -.03925    -.01636     .02452     .11184    -.06566     .01492    -.06830    -.03451     .06688     .06913    -.06373    -.09729
C34       -.02630    -.05937    -.04577     .05973     .05992    -.02558    -.04577     .22959    -.01676     .01236    -.11987    -.06520
C35       -.01450    -.03272    -.02523     .09523     .07170    -.04926     .17285     .05622    -.04803    -.05599     .01584    -.03593
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|  | C25 | C26 | C27 | C28 | C29 | C30 | C31 | C32 | C33 | C34 | C35 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | .04485 | .01928 | -.05113 | -.03797 | -.03367 | .61253 | .46427 | .04192 | .29182 | -.05150 | .09088 |
| C2 | -.03742 | .00990 | -.03017 | -.00769 | .01554 | -.19531 | -.07964 | -.00501 | -.03728 | .06441 | -.01788 |
| C3 | -.09390 | -.00998 | -.00275 | -.02395 | -.00963 | .10405 | .08333 | -.14438 | -.01424 | -.13000 | .15850 |
| C4 | .14961 | .01368 | -.04583 | .04184 | -.05205 | -.03162 | -.03245 | .14263 | .09286 | .09165 | .01869 |
| C5 | .02538 | .06005 | -.04950 | .13117 | .03822 | .09921 | .19777 | -.06519 | .02830 | -.08500 | -.04685 |
| C6 | .01318 | .00611 | -.01237 | -.13064 | .03354 | -.08800 | -.06278 | -.01910 | .02950 | -.05194 | .06809 |
| C7 | -.01900 | .14059 | -.01532 | -.02460 | .06692 | -.02846 | -.01371 | -.03674 | .12076 | -.02630 | -.01450 |
| C8 | -.03827 | -.06790 | -.03085 | -.04955 | .06544 | -.03682 | -.00204 | .09291 | .00152 | -.05298 | .14275 |
| C9 | -.13138 | -.04045 | .08690 | -.09270 | .01861 | -.09583 | -.05096 | -.08453 | -.09309 | -.01775 | .02141 |
| C10 | -.02693 | .07576 | -.02171 | .11913 | -.00276 | .01612 | -.00795 | .06538 | -.05563 | -.03728 | -.02055 |
| C11 | -.02693 | -.04779 | -.02171 | -.03487 | -.00276 | .01213 | -.01852 | -.05208 | .05777 | -.03728 | -.02055 |
| C12 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 | 99.00000 |
| C13 | -.01900 | -.03371 | -.01532 | -.02460 | -.07082 | .10327 | -.01381 | -.03674 | -.03925 | -.02630 | -.01450 |
| C14 | .07834 | .00260 | -.03458 | -.05553 | -.03550 | .02843 | -.01208 | -.00812 | -.01636 | -.05937 | -.03272 |
| C15 | -.03306 | -.05867 | -.02666 | .08324 | .11646 | .20481 | .39919 | -.06394 | .02452 | -.04577 | -.02523 |
| C16 | -.16917 | .15784 | -.01789 | .08229 | -.06260 | .10558 | -.01442 | -.03081 | .11184 | .05973 | .09523 |
| C17 | -.05810 | -.10310 | -.04685 | -.07523 | .01744 | .13384 | -.01365 | .05659 | -.06566 | .05992 | .07170 |
| C18 | -.06455 | -.11455 | -.05205 | -.08358 | -.02790 | -.06130 | -.04137 | .02874 | .01492 | -.02558 | -.04926 |
| C19 | -.03306 | -.05867 | -.02666 | -.04281 | .03656 | .17330 | -.01929 | .03220 | -.06830 | -.04577 | .17285 |
| C20 | -.06455 | -.11455 | -.05205 | -.08358 | -.07045 | -.07983 | -.03735 | -.12485 | -.03451 | .22959 | .05622 |
| C21 | -.13919 | -.24699 | -.11223 | -.18023 | -.02602 | .14643 | .13361 | -.01505 | .06688 | -.01676 | -.04803 |
| C22 | -.07337 | -.13020 | -.05916 | -.09501 | -.00753 | -.00358 | -.04379 | .08670 | .06913 | .01236 | -.05599 |
| C23 | -.08658 | -.15364 | -.06981 | -.11210 | .00764 | .07526 | -.04416 | .03132 | -.06373 | -.11987 | .01584 |
| C24 | -.04709 | -.08357 | -.03797 | -.06098 | .05208 | -.02777 | -.03127 | -.02261 | -.09729 | -.06520 | -.03593 |
| C25 | 1.00000 | -.13512 | -.06140 | -.09859 | .01059 | -.08656 | -.05280 | -.01441 | -.07180 | .00495 | .12438 |
| C26 | -.13512 | 1.00000 | -.10895 | -.17495 | .14146 | -.12351 | -.07741 | -.06008 | .10946 | .02788 | -.04387 |
| C27 | -.06140 | -.10895 | 1.00000 | -.07950 | -.09533 | -.06855 | .04855 | .04194 | -.02342 | -.01826 | -.04685 |
| C28 | -.09859 | -.17495 | -.07950 | 1.00000 | -.03990 | .01254 | .11564 | -.08317 | .00392 | -.00253 | -.00139 |
| C29 | .01059 | .14146 | -.09533 | -.03990 | 1.00000 | -.10755 | .01807 | .06441 | -.14775 | .08827 | .06425 |
| C30 | -.08656 | -.12351 | -.06855 | .01254 | -.10755 | 1.00000 | .53882 | .05253 | .02610 | -.13194 | -.00821 |
| C31 | -.05280 | -.07741 | .04855 | .11564 | .01807 | .53882 | 1.00000 | -.00695 | .11397 | -.04265 | -.03304 |
| C32 | -.01441 | -.06008 | .04194 | -.08317 | .06441 | .05253 | -.00695 | 1.00000 | -.30426 | -.20389 | -.11238 |
| C33 | -.07180 | .10946 | -.02342 | .00392 | -.14775 | .02610 | .11397 | -.30426 | 1.00000 | -.21779 | -.12004 |
| C34 | .00495 | .02788 | -.01826 | -.00253 | .08827 | -.13194 | -.04265 | -.20389 | -.21779 | 1.00000 | -.08044 |
| C35 | .12438 | -.04387 | -.04685 | -.00139 | .06425 | -.00821 | -.03304 | -.11238 | -.12004 | -.08044 | 1.00000 |

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FULL-STEPWISE-REGRESSION                                                                   04/25/88        PAGE    6

FILE    STUDYDWS (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                 REGRESSION LIST  1
DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  1..     C30


MULTIPLE R              .61253                ANALYSIS OF VARIANCE     DF        SUM OF SQUARES        MEAN SQUARE              F
R SQUARE                .37519                REGRESSION                1.        116778.95854       116778.95854        126.10266
ADJUSTED R SQUARE       .37222                RESIDUAL                210.        194473.15466          926.06264
STANDARD ERROR        30.43128


----------------- VARIABLES IN THE EQUATION ------------------           ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE              B             BETA      STD ERROR B        F          VARIABLE        BETA IN       PARTIAL    TOLERANCE           F

C30             .1577915E-04      .61253         .00000      126.103        C2            -.00375       -.00466       .96186          .005
(CONSTANT)      54.27751                                                    C3            -.19254       -.24226       .98917        13.031
                                                                            C4             .22331        .28237       .99900        18.108
                                                                            C5             .06234        .07847       .99016         1.295
                                                                            C6             .15524        .19564       .99226         8.318
                                                                            C7             .03200        .04047       .99919          .343
                                                                            C8             .11262        .14238       .99864         4.324
                                                                            C9            -.16290       -.20513       .99082         9.181
                                                                            C10           -.07078       -.08953       .99974         1.689
                                                                            C11           -.06578       -.08321       .99985         1.457
                                                                            C12       999999.99999  99999.99999       .00000     99999.999
                                                                            C13           -.02744       -.03453       .98934          .250
                                                                            C14            .09418        .11910       .99919         3.007
                                                                            C15            .03037        .03761       .95805          .296
                                                                            C16            .24316        .30590       .98885        21.576
                                                                            C17           -.12088       -.15154       .98209         4.913
                                                                            C18            .08117        .10249       .99624         2.219
                                                                            C19            .01766        .02200       .96997          .101
                                                                            C20           -.05020       -.06330       .99363          .841
                                                                            C21            .05885        .07364       .97856         1.140
                                                                            C22           -.03334       -.04217       .99999          .372
                                                                            C23           -.10670       -.13460       .99434         3.856
                                                                            C24           -.10959       -.13859       .99923         4.093
                                                                            C25            .09861        .12428       .99251         3.279
                                                                            C26            .09641        .12103       .98475         3.107
                                                                            C27           -.00919       -.01160       .99530          .028
                                                                            C28           -.04566       -.05777       .99984          .700
                                                                            C29            .03258        .04098       .98843          .352
                                                                            C31            .18913        .20157       .70967         8.851
                                                                            C32            .00977        .01234       .99724          .032
                                                                            C33            .27602        .34907       .99932        29.000
                                                                            C34            .02984        .03742       .98259          .293
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FULL-STEPWISE-REGRESSION                                                                              04/25/88         PAGE    8

FILE    STUDYDWS (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                 REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  2..    C33


MULTIPLE R              .67181                ANALYSIS OF VARIANCE    DF       SUM OF SQUARES        MEAN SQUARE           F
R SQUARE                .45132                REGRESSION               2.        140475.52927        70237.76463      85.95846
ADJUSTED R SQUARE       .44607                RESIDUAL               209.        170776.58394          817.11284
STANDARD ERROR        28.58519


----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE              B           BETA      STD ERROR B        F          VARIABLE        BETA IN      PARTIAL    TOLERANCE           F

C30         .1559355E-04        .60532         .00000    139.479          C2               .00549       .00726       .96082         .011
C33          24.58086           .27602        4.56452     29.000          C3             -.18786      -.25220       .98889       14.129
(CONSTANT)   48.40854                                                      C4               .19918       .26758       .99022       16.041
                                                                           C5               .05521       .07414       .98950        1.150
                                                                           C6               .14655       .19698       .99124        8.396
                                                                           C7             -.00159      -.00213       .98442         .001
                                                                           C8               .11193       .15101       .99864        4.854
                                                                           C9             -.13881      -.18576       .98260        7.434
                                                                           C10            -.05548      -.07477       .99660        1.169
                                                                           C11            -.08191      -.11039       .99655        2.566
                                                                           C12        999999.99999 99999.99999       .00000    99999.999
                                                                           C13            -.01577      -.02116       .98758         .093
                                                                           C14              .09893       .13349       .99890        3.774
                                                                           C15              .02486       .03284       .95768         .225
                                                                           C16              .21530       .28729       .97695       18.712
                                                                           C17            -.10194      -.13605       .97730        3.922
                                                                           C18              .07661       .10322       .99597        2.240
                                                                           C19              .03859       .05117       .96466         .546
                                                                           C20            -.04124      -.05546       .99258         .642
                                                                           C21              .04123       .05495       .97458         .630
                                                                           C22            -.05270      -.07097       .99519        1.053
                                                                           C23            -.08885      -.11935       .99002        3.006
                                                                           C24            -.08370      -.11242       .98990        2.663
                                                                           C25              .11852       .15902       .98767        5.396
                                                                           C26              .06567       .08741       .97204        1.601
                                                                           C27            -.00319      -.00430       .99483         .004
                                                                           C28            -.04666      -.06298       .99983         .828
                                                                           C29              .07465       .09912       .96741        2.064
                                                                           C31              .15242       .17212       .69968        6.351
                                                                           C32              .10412       .13363       .90377        3.782
                                                                           C34              .09447       .12343       .93662        3.218
                                                                           C35              .13088       .17541       .98557        6.603
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  3..    C16


MULTIPLE R             .70471                   ANALYSIS OF VARIANCE    DF      SUM OF SQUARES      MEAN SQUARE            F
R SQUARE               .49661                   REGRESSION               3.       154570.90318      51523.63439         68.39950
ADJUSTED R SQUARE      .48935                   RESIDUAL               208.       156681.21002        753.27505
STANDARD ERROR       27.44586


----------------- VARIABLES IN THE EQUATION ------------------         ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE          B            BETA     STD ERROR B        F            VARIABLE      BETA IN      PARTIAL   TOLERANCE          F

C30          .1502375E-04      .58320        .00000     138.944         C2             -.00210      -.00291      .95964         .002
C33          22.48792          .25251       4.40922      26.012         C3             -.15304      -.21067      .95393        9.614
C16          21.97169          .21530       5.07928      18.712         C4              .17806       .24826      .97855       13.596
(CONSTANT)   31.17337                                                   C5              .04913       .06886      .98869         .986
                                                                        C6              .12743       .17802      .98234        6.774
                                                                        C7             -.00616      -.00861      .98397         .015
                                                                        C8              .09808       .13783      .99413        4.008
                                                                        C9             -.12285      -.17112      .97666        6.244
                                                                        C10            -.03815      -.05349      .98981         .594
                                                                        C11            -.06230      -.08726      .98762        1.588
                                                                        C12         999999.99999 99999.99999     .00000    99999.999
                                                                        C13            -.02119      -.02968      .98695         .182
                                                                        C14             .10189       .14351      .99871        4.353
                                                                        C15             .04218       .05800      .95179         .699
                                                                        C17            -.08110      -.11243      .96741        2.650
                                                                        C18             .05340       .07464      .98348        1.160
                                                                        C19             .05277       .07290      .96066        1.106
                                                                        C20            -.04221      -.05927      .99256         .730
                                                                        C21             .04409       .06134      .97441         .782
                                                                        C22            -.04440      -.06238      .99366         .809
                                                                        C23            -.07218      -.10090      .98367        2.129
                                                                        C24            -.07073      -.09900      .98611        2.049
                                                                        C25             .15550       .21517      .96388       10.049
                                                                        C26             .03138       .04302      .94630         .384
                                                                        C27            -.00140      -.00197      .99476         .001
                                                                        C28            -.06444      -.09051      .99318        1.710
                                                                        C29             .08264       .11449      .96612        2.749
                                                                        C31             .17950       .21057      .69276        9.604
                                                                        C32             .10484       .14047      .90376        4.167
                                                                        C34             .07291       .09894      .92697        2.046
                                                                        C35             .10837       .15069      .97336        4.810
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FULL-STEPWISE-REGRESSION                                                             04/25/88       PAGE   10

FILE   STUDYDWS (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1
DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  4..    C4


MULTIPLE R            .72639                   ANALYSIS OF VARIANCE      DF       SUM OF SQUARES         MEAN SQUARE                F
R SQUARE              .52764                   REGRESSION                 4.        164227.96156         41056.99039         57.80545
ADJUSTED R SQUARE     .51851                   RESIDUAL                 207.        147024.15165           710.26160
STANDARD ERROR      26.65073


------------------ VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE            B          BETA     STD ERROR B          F          VARIABLE        BETA IN     PARTIAL   TOLERANCE            F

C30          .1523154E-04     .59127        .00000     151.150          C2              -.02123     -.03009      .94906         .187
C33          21.19053         .23795       4.29591      24.332          C3              -.11356     -.15573      .88836        5.120
C16          19.98567         .19584       4.96145      16.226          C5               .08534      .12127      .95395        3.075
C4           13.92156         .17806       3.77550      13.596          C6               .20580      .28104      .88088       17.666
(CONSTANT)   27.37915                                                   C7               .00671      .00965      .97884         .019
                                                                        C8               .07116      .10185      .96769        2.159
                                                                        C9               .08131      .06510      .30275         .877
                                                                        C10             -.02654     -.03833      .98547         .303
                                                                        C11             -.04912     -.07083      .98193        1.039
                                                                        C12        999999.99999 99999.99999      .00000    99999.999
                                                                        C13             -.03749     -.05397      .97892         .602
                                                                        C14              .12580      .18150      .98321        7.017
                                                                        C15              .05854      .08278      .94440        1.421
                                                                        C17             -.06284     -.08942      .95656        1.661
                                                                        C18              .05159      .07444      .98337        1.148
                                                                        C19              .03746      .05322      .95343         .585
                                                                        C20             -.03903     -.05657      .99223         .661
                                                                        C21              .03644      .05228      .97259         .565
                                                                        C22             -.04667     -.06768      .99350         .948
                                                                        C23             -.04807     -.06868      .96408         .976
                                                                        C24             -.05895     -.08498      .98155        1.499
                                                                        C25              .12801      .18003      .93433        6.901
                                                                        C26              .03480      .04925      .94596         .501
                                                                        C27              .00668      .00969      .99269         .019
                                                                        C28             -.07045     -.10209      .99206        2.170
                                                                        C29              .08978      .12830      .96465        3.448
                                                                        C31              .18362      .22233      .69251       10.712
                                                                        C32              .07318      .09949      .87308        2.060
                                                                        C34              .05485      .07644      .91737        1.211
                                                                        C35              .10516      .15093      .97304        4.802
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                   REGRESSION LIST  1

DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  5..     C6

                                                                                                                                  F
MULTIPLE R              .75163               ANALYSIS OF VARIANCE    DF      SUM OF SQUARES       MEAN SQUARE         53.50082
R SQUARE                .56495               REGRESSION               5.       175840.54450       35168.10890
ADJUSTED R SQUARE       .55439               RESIDUAL               206.       135411.56870         657.33771
STANDARD ERROR        25.63860

----------------- VARIABLES IN THE EQUATION ------------------       ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE           B            BETA      STD ERROR B       F        VARIABLE         BETA IN       PARTIAL    TOLERANCE          F

C30         .1583180E-04      .61457         .00000     173.948      C2               .00111        .00163      .93703          .001
C33         20.31549          .22812        4.13801      24.103      C3             -.07524       -.10530      .85213         2.299
C16         17.24125          .16895        4.81748      12.808      C5               .11713        .17153      .93311         6.215
C4          19.10252          .24433        3.83558      24.804      C7               .01863        .02789      .97523          .160
C6          24.45021          .20580        5.81718      17.666      C8               .07298        .10884      .96761         2.458
(CONSTANT)  24.39319                                                 C9               .01214        .00993      .29084          .020
                                                                     C10             -.01704       -.02561      .98310          .135
                                                                     C11             -.03844       -.05765      .97891          .684
                                                                     C12        999999.99999 99999.99999      .00000     99999.999
                                                                     C13             -.03990       -.05984      .97877          .737
                                                                     C14              .14652        .21919      .97357        10.346
                                                                     C15              .06886        .10133      .94194         2.127
                                                                     C17             -.07568       -.11199      .95270         2.604
                                                                     C18              .05854        .08795      .98215         1.598
                                                                     C19              .03599        .05328      .95338          .584
                                                                     C20             -.01898       -.02851      .98140          .167
                                                                     C21              .03156        .04717      .97198          .457
                                                                     C22             -.03986       -.06020      .99225          .746
                                                                     C23             -.05033       -.07492      .96395         1.157
                                                                     C24             -.08061       -.12039      .97044         3.015
                                                                     C25              .11184        .16330      .92758         5.617
                                                                     C26              .04122        .06075      .94499          .759
                                                                     C27              .01321        .01995      .99157          .082
                                                                     C28             -.04499       -.06732      .97384          .933
                                                                     C29              .08559        .12741      .96420         3.383
                                                                     C31              .18839        .23763      .69222        12.269
                                                                     C32              .06129        .08668      .87008         1.552
                                                                     C34              .06275        .09105      .91599         1.714
                                                                     C35              .09157        .13660      .96803         3.898
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FULL-STEPWISE-REGRESSION                                                                 04/25/88        PAGE  12

FILE   STUDYDWS (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
DEPENDENT VARIABLE..   C1                                                                                       REGRESSION LIST  1

VARIABLE(S) ENTERED ON STEP NUMBER  6..    C31

MULTIPLE R              .76780             ANALYSIS OF VARIANCE    DF      SUM OF SQUARES       MEAN SQUARE            F
R SQUARE                .58951             REGRESSION              6.        183487.11460       30581.18577     49.06777
ADJUSTED R SQUARE       .57750             RESIDUAL              205.        127764.99861         623.24390
STANDARD ERROR        24.96485

----------------- VARIABLES IN THE EQUATION ------------------     ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE          B               BETA     STD ERROR B          F     VARIABLE        BETA IN     PARTIAL   TOLERANCE             F

C30          .1320098E-04        .51245        .00000      90.279     C2              -.00522     -.00789      .93560          .013
C33          18.44764            .20715       4.06440      20.601     C3              -.07660     -.11036      .85208         2.515
C16          18.78022            .18403       4.71142      15.889     C5               .09186      .13642      .90532         3.868
C4           19.42509            .24846       3.73592      27.035     C7               .02074      .03196      .97506          .209
C6           24.85116            .20918       5.66547      19.241     C8               .06807      .10446      .96666         2.250
C31          .9569720E-05        .18839        .00000      12.269     C9               .01730      .01456      .29075          .043
(CONSTANT)   24.22126                                                 C10             -.01326     -.02052      .98254          .086
                                                                      C11             -.03066     -.04729      .97651          .457
                                                                      C12        999999.99999 99999.99999      .00000     99999.999
                                                                      C13             -.02821     -.04344      .97330          .386
                                                                      C14              .15263      .23489      .97223        11.913
                                                                      C15              .01498      .02130      .83004          .093
                                                                      C17             -.05902     -.08938      .94158         1.643
                                                                      C18              .05875      .09088      .98215         1.699
                                                                      C19              .05862      .08853      .93616         1.612
                                                                      C20             -.02037     -.03150      .98132          .203
                                                                      C21              .02225      .03418      .96859          .239
                                                                      C22             -.03003     -.04659      .98828          .444
                                                                      C23             -.03374     -.05142      .95306          .541
                                                                      C24             -.07847     -.12064      .97026         3.013
                                                                      C25              .11345      .17054      .92749         6.111
                                                                      C26              .04314      .06545      .94485          .878
                                                                      C27             -.00310     -.00479      .98097          .005
                                                                      C28             -.06827     -.10414      .95521         2.237
                                                                      C29              .06933      .10564      .95320         2.302
                                                                      C32              .06156      .08962      .87008         1.652
                                                                      C34              .05090      .07583      .91097         1.180
                                                                      C35              .09274      .14241      .96798         4.223
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *    VARIABLE LIST  1
                                                                                                                  REGRESSION LIST  1

DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER  7..     C14


MULTIPLE R              .78241                    ANALYSIS OF VARIANCE    DF      SUM OF SQUARES       MEAN SQUARE            F
R SQUARE                .61216                    REGRESSION               7.       190536.62661       27219.51809       45.99892
ADJUSTED R SQUARE       .59885                    RESIDUAL               204.       120715.48660         591.74258
STANDARD ERROR        24.32576

----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE            B             BETA     STD ERROR B        F         VARIABLE       BETA IN      PARTIAL    TOLERANCE          F

                                                                        C2              .00839       .01299      .92850         .034
C30          .1305691E-04        .50685         .00000     92.932      C3            -.05791      -.08521      .83986        1.485
C33          18.38505            .20644        3.96039     21.550      C5            -.04083      -.04398      .45011         .393
C16          18.62533            .18251        4.59102     16.458      C7             .02432       .03856      .97452         .302
C4           21.34032            .27295        3.68233     33.586      C8             .06792       .10723      .96666        2.361
C6           26.76205            .22526        5.54813     23.267      C9             .18918       .14479      .22717        4.347
C31          .9911126E-05        .19511         .00000     13.841      C10           -.00837      -.01331      .98151         .036
C14          38.53831            .15263       11.16554     11.913      C11           -.02562      -.04064      .97543         .336
(CONSTANT)   22.53581                                                   C12       999999.99999  99999.99999      .00000    99999.999
                                                                        C13           -.02753      -.04360      .97328         .387
                                                                        C15            .02024       .02959      .82920         .178
                                                                        C17           -.05108      -.07948      .93903        1.291
                                                                        C18            .06428       .10222      .98089        2.143
                                                                        C19            .06178       .09596      .93578        1.887
                                                                        C20           -.01314      -.02087      .97908         .088
                                                                        C21            .00927       .01460      .96154         .043
                                                                        C22           -.02316      -.03693      .98622         .277
                                                                        C23           -.03949      -.06186      .95176         .780
                                                                        C24           -.07432      -.11750      .96953        2.842
                                                                        C25            .09714       .14926      .91580        4.626
                                                                        C26            .04242       .06621      .94483         .894
                                                                        C27            .00287       .00456      .97946         .004
                                                                        C28           -.05910      -.09257      .95166        1.755
                                                                        C29            .07491       .11736      .95199        2.835
                                                                        C32            .05942       .08900      .86993        1.621
                                                                        C34            .05888       .09013      .90872        1.663
                                                                        C35            .09660       .15256      .96738        4.838
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FILE   STUDYDWS (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                    REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  8..    C35

MULTIPLE R              .78816                  ANALYSIS OF VARIANCE    DF      SUM OF SQUARES      MEAN SQUARE            F
R SQUARE                .62119                  REGRESSION               8.      193346.36458       24168.29557        41.61090
ADJUSTED R SQUARE       .60626                  RESIDUAL               203.      117905.74862         580.81650
STANDARD ERROR        24.10013

----------------- VARIABLES IN THE EQUATION ------------------        ------------- VARIABLES NOT IN THE EQUATION --------------

VARIABLE             B            BETA      STD ERROR B        F        VARIABLE       BETA IN      PARTIAL    TOLERANCE          F

C30          .1306094E-04       .50701          .00000    94.739        C2             .01079       .01689      .92795         .058
C33          19.55601           .21959         3.95961    24.392        C3            -.08402      -.12219      .80120        3.061
C16          17.64476           .17290         4.57024    14.906        C5            -.03766      -.04104      .44988         .341
C4           21.05145           .26926         3.65054    33.254        C7             .02409       .03863      .97452         .302
C6           25.92784           .21824         5.50974    22.145        C8             .05566       .08806      .94829        1.579
C31          .9958779E-05       .19605          .00000    14.237        C9             .18139       .14035      .22680        4.059
C14          39.14286           .15502        11.06539    12.513        C10           -.00695      -.01119      .98130         .025
C35          18.35833           .09660         8.34679     4.838        C11           -.02572      -.04127      .97543         .345
(CONSTANT)   22.47253                                                   C12        999999.99999  99999.99999      .00000    99999.999
                                                                        C13           -.02510      -.04023      .97266         .327
                                                                        C15            .02094       .03098      .82916         .194
                                                                        C17           -.05871      -.09217      .93382        1.731
                                                                        C18            .07031       .11294      .97732        2.610
                                                                        C19            .04577       .07079      .90623        1.017
                                                                        C20           -.01890      -.03034      .97563         .186
                                                                        C21            .01310       .02085      .96006         .088
                                                                        C22           -.01902      -.03065      .98434         .190
                                                                        C23           -.04146      -.06570      .95138         .876
                                                                        C24           -.06971      -.11138      .96715        2.538
                                                                        C25            .08537       .13155      .89938        3.557
                                                                        C26            .04729       .07459      .94259        1.130
                                                                        C27            .00743       .01194      .97726         .029
                                                                        C28           -.05896      -.09344      .95166        1.779
                                                                        C29            .07012       .11101      .94950        2.520
                                                                        C32            .07888       .11782      .84510        2.844
                                                                        C34            .07256       .11149      .89436        2.542
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                    REGRESSION LIST  1
DEPENDENT VARIABLE..    C1

VARIABLE(S) ENTERED ON STEP NUMBER  9..    C9


MULTIPLE R           .79287                    ANALYSIS OF VARIANCE    DF      SUM OF SQUARES       MEAN SQUARE            F
R SQUARE             .62865                    REGRESSION               9.       195668.83263       21740.98140      37.99579
ADJUSTED R SQUARE    .61211                    RESIDUAL               202.       115583.28058         572.19446
STANDARD ERROR     23.92059


---------------- VARIABLES IN THE EQUATION -----------------           ------------ VARIABLES NOT IN THE EQUATION -------------

VARIABLE          B             BETA     STD ERROR B        F          VARIABLE      BETA IN      PARTIAL    TOLERANCE          F

C30          .1350130E-04      .52411         .00000    100.065          C2               .00706       .01115       .92634          .025
C33          19.79271          .22225        3.93187     25.340          C3              -.06389      -.09087       .75119         1.674
C16          17.69783          .17342        4.53627     15.221          C5               .04766       .04380       .31359          .386
C4           32.88517          .42062        6.90145     22.705          C7               .02043       .03307       .97278          .220
C6           24.03747          .20233        5.54860     18.768          C8               .05676       .09070       .94815         1.667
C31          .1016660E-04      .20014         .00000     15.037          C10              .02688       .04092       .86097          .337
C14          50.83213          .20132       12.42133     16.747          C11              .00547       .00831       .85662          .014
C35          17.68011          .09303        8.29145      4.547          C12         999999.99999  99999.99999       .00000     99999.999
C9           13.90079          .18139        6.89980      4.059          C13             -.02687      -.04348       .97226          .381
(CONSTANT)   10.17404                                                    C15              .07059       .09655       .69470         1.891
                                                                         C17             -.06998      -.11023       .92133         2.472
                                                                         C18              .06541       .10593       .97396         2.281
                                                                         C19              .04116       .06421       .90378          .832
                                                                         C20             -.02554      -.04129       .97024          .343
                                                                         C21              .01562       .02510       .95928          .127
                                                                         C22             -.02687      -.04358       .97674          .382
                                                                         C23             -.04133      -.06616       .95138          .884
                                                                         C24             -.06370      -.10253       .96211         2.135
                                                                         C25              .08558       .13318       .89938         3.630
                                                                         C26              .05526       .08773       .93576         1.559
                                                                         C27              .00074       .00119       .97152          .000
                                                                         C28             -.04893      -.07775       .93764         1.222
                                                                         C29              .08064       .12819       .93841         3.358
                                                                         C32              .07154       .10754       .83921         2.352
                                                                         C34              .06617       .10240       .88947         2.130
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FULL-STEPWISE-REGRESSION                                                          04/25/88          PAGE   16

FILE    STUDYDWS (CREATION DATE = 04/25/88)

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * *   VARIABLE LIST  1
                                                                                                                    REGRESSION LIST  1

DEPENDENT VARIABLE..     C1

VARIABLE(S) ENTERED ON STEP NUMBER 10..     C25


MULTIPLE R              .79702                      ANALYSIS OF VARIANCE      DF       SUM OF SQUARES        MEAN SQUARE               F
R SQUARE                .63524                      REGRESSION                10.        197719.03928        19771.90393         35.00436
ADJUSTED R SQUARE       .61709                      RESIDUAL                 201.        113533.07393          564.84116
STANDARD ERROR        23.76639


----------------- VARIABLES IN THE EQUATION ------------------          ------------- VARIABLES NOT IN THE EQUATION -------------

VARIABLE             B            BETA     STD ERROR B          F        VARIABLE        BETA IN       PARTIAL    TOLERANCE             F

C30            .1360927E-04      .52830          .00000    102.812        C2              .01147        .01825      .92384           .067
C33            20.19294          .22674         3.91217     26.642        C3             -.05644       -.08071      .74591          1.311
C16            19.45715          .19066         4.60065     17.886        C5              .04393        .04071      .31337           .332
C4             31.47650          .40260         6.89671     20.830        C7              .01959        .03198      .97268           .205
C6             23.12452          .19464         5.53362     17.463        C8              .06399        .10282      .94184          2.137
C31            .1019022E-04      .20060          .00000     15.304        C10             .02913        .04474      .86041           .401
C14            48.41814          .19176        12.40613     15.232        C11             .00715        .01095      .85631           .024
C35            15.55958          .08187         8.31285      3.503        C12        999999.99999   99999.99999     .00000      99999.999
C9             13.93058          .18177         6.85534      4.129        C13            -.02491       -.04065      .97170           .331
C25            12.78842          .08558         6.71245      3.630        C15             .07067        .09753      .69470          1.921
(CONSTANT)     8.418014                                                   C17            -.06482       -.10281      .91754          2.137
                                                                          C18             .06893        .11254      .97229          2.566
                                                                          C19             .04799        .07532      .89846          1.141
                                                                          C20            -.02003       -.03260      .96575           .213
                                                                          C21             .02848        .04567      .93836           .418
                                                                          C22            -.02135       -.03486      .97217           .243
                                                                          C23            -.03429       -.05517      .94405           .611
                                                                          C24            -.05910       -.09583      .95888          1.854
                                                                          C26             .06543        .10414      .92414          2.193
                                                                          C27             .00500        .00814      .96894           .013
                                                                          C28            -.04265       -.06817      .93192           .934
                                                                          C29             .08169        .13101      .93827          3.493
                                                                          C32             .07658        .11598      .83673          2.727
                                                                          C34             .06605        .10313      .88947          2.150
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